NOTE

This Microfiche meets the quality requirements of the American National Standard for Microfiche of Documents (ANSI PH5.9-1975). However, because of imperfections in the document from which it was made, it contains images that are illegible or difficult to read. The source document for this microfiche is the best copy that could be obtained prior to filming.

CIS Congressional Information Service Washington, D.C.

CONGRESS OF THE UNITED STATES
CONGRESSIONAL BUDGET OFFICE

OCTOBER 1989

Moving the Marine Corps by Sea in the 1990s

A SPECIAL STUDY

MOVING THE MARINE CORPS BY SEA IN THE 1990s

The Congress of the United States
Congressional Budget Office

NOTES

All years referred to in this report are fiscal years unless otherwise indicated.

All costs are expressed in fiscal year 1990 dollars of budget authority unless otherwise indicated.

Details in the text and tables may not add to totals because of rounding.

On the cover is an official U.S. Navy photograph taken by PHCS Ron Bayles in 1986.

PREFACE

Since the island-hopping campaign in the Pacific Ocean during World War II, the Marine Corps has viewed the ability to conduct amphibious assaults--attacks launched from the sea against targets on land--as its primary mission. In support of this mission, the U.S. Navy operates a fleet of 63 amphibious warfare ships that have been specially designed for amphibious operations.

The Administration's goal is to provide enough capacity--commonly referred to as amphibious lift--in the amphibious warfare fleet to transport the assault echelons of one Marine Expeditionary Force and one Marine Expeditionary Brigade, which include about 50,000 troops and associated aircraft, vehicles, and equipment. If all of the amphibious ships in the Administration's shipbuilding plan for 1990 through 1994 are procured, nearly all of the Administration's amphibious lift goals would be reached by 1998. Money to fund all of the Administration's plan might not be available, however, which may prompt a review of alternative approaches to meeting amphibious warfare needs.

This analysis by the Congressional Budget Office (CBO) addresses the Administration's goals for amphibious ships and its plan for meeting those goals. The report also discusses alternative strategies that require less funding, including one that envisions a reduced goal for the amphibious fleet. (A forthcoming CBO study will address the Marine Corps' requirements for aircraft.) The study was requested by the House Committee on Armed Services. In keeping with CBO's mandate to provide objective analysis, the study contains no recommendations.

Michael B. Berger of CBO's National Security Division prepared the study under the general supervision of Robert F. Hale and John D. Mayer, Jr.; William P. Myers of CBO's Budget Analysis Division provided detailed cost analysis. The author gratefully acknowledges the contributions of Elizabeth Chambers, William Kostak, Jonathan Ladinsky, and V. Lane Pierrot of CBO's National Security Division, Michael Deich of CBO's Natural Resources and Commerce Division, and William F. Morgan of the Center for Naval Analyses. (The assistance of external participants implies no responsibility for the final product, which rests solely with CBO.) Sherry Snyder edited the manuscript. Patricia Frisby prepared the earlier drafts, and Kathryn Quattrone prepared the report for publication.

Robert D. Reischauer
Director

October 1989

CONTENTS

	SUMMARY	ix
I	INTRODUCTION	1
II	MARINE CORPS MISSIONS AND ORGANIZATION	3
	Amphibious Assault *3*	
	Other Marine Corps Missions *11*	
	Organization *14*	
III	SHIPS AND THE CURRENT GOAL FOR AMPHIBIOUS LIFT	19
	Types of Ships in Today's Amphibious Fleet *19*	
	Goal for Amphibious Shipping *21*	
	Recent Uses of Amphibious Forces and the Administration's Goal *24*	
	Progress Toward Meeting the Current Goal *27*	
IV	ADMINISTRATION PLAN FOR AMPHIBIOUS LIFT	29
	The Plan and Its Cost *29*	
	Meeting the Current Goal *31*	
	Retaining Ships for 35 Years *32*	
	Downward Pressure on Budget Share *40*	
V	ALTERNATIVES TO THE ADMINISTRATION PLAN	45
	Option 1: Reduce Operating and Support Costs Through Selective Retirements *45*	

Option 2: Reduce Procurement Costs *50*
Option 3: Reduce Goal for Amphibious Lift and Retire Ships After 30 Years *52*
Conclusion *56*

APPENDIXES

A Types and Classes of Amphibious Ships *61*

B Long-Term Funding for Amphibious Ships and Landing Craft *69*

TABLES

1.	Personnel and Selected Equipment in Marine Corps Notional Task Forces	15
2.	Distribution of Troops and Equipment Among the Assault Echelon, the Assault Follow-on Echelon, and the Fly-in Echelon in Marine Corps Task Forces	16
3.	Amphibious Ships and Landing Craft in the Administration's Shipbuilding Plan for 1990 Through 1994	20
4.	Goal for Amphibious Lift for the Assault Echelons of One Marine Expeditionary Force and One Marine Expeditionary Brigade	21
5.	U.S. Marine Corps Forces Used in Various Landings Since World War II	25
6.	Procurement of Amphibious Warfare Ships and Landing Craft in the Administration's Shipbuilding Plan for 1990 Through 1994	30
7.	Procurement Required to Meet the Current Goal for Amphibious Lift by 1998 if Ships are Retired at 30 Years	35
8.	Description of the Administration Plan and Alternatives	46
9.	Effects of the Administration Plan and Alternatives on Selected Measures of Cost and Capability	47
A-1.	Current Amphibious Ships and Ships Under Construction	61

FIGURES

1.	Amphibious Lift Capability Under the Administration Plan	32
2.	Amphibious Lift Capability Assuming 30-Year Service Life and the Administration's 1990-1994 Shipbuilding Plan	34
3.	Funding for Amphibious Ships as a Share of the Navy's Shipbuilding and Conversion (SCN) Account	41
4.	Option 1: Reduce Operating and Support Costs Through Selective Retirements	49
5.	Option 2: Reduce Procurement Costs	51
6.	Option 3: Reduce Goal for Amphibious Lift and Retire Ships After 30 Years	54
7.	Option 3: Amphibious Lift Under the Reduced Goal of Option 3 Compared With the Current Goal	55

SUMMARY

The U.S. Navy currently operates 63 amphibious warfare ships. These vessels have been designed from the keel up to transport and support forces of the U.S. Marine Corps. The Navy and Marine Corps provide the United States with an ability to project military power from the sea against targets on land that is unmatched by any other country. Since the island-hopping campaign in the Pacific Ocean during World War II, this ability to conduct an amphibious assault, as it is called, has become the Marine Corps' primary mission. Amphibious assault has also played a key role in a number of major military battles; for example, the amphibious assault at Inchon, South Korea, in 1950 is widely credited with turning the tide of the Korean War.

Maintaining the capability to conduct large amphibious assaults will, however, add substantially to future U.S. defense costs. In addition to the costs of maintaining troops and providing necessary aircraft, many amphibious ships will reach the end of their service lives during the next 15 years or so and will have to be replaced if U.S. capability is to be maintained. Critics argue that these investments would not be wise because changes in technology, especially the proliferation of precision-guided weapons, have made amphibious assaults militarily obsolete.

This study focuses on alternative approaches to meeting needs for amphibious ships.[1] After describing the Administration's goal and analyzing how well the current shipbuilding plan meets the goal, the study then examines three options for modernizing amphibious shipping that reflect different military priorities and budget strategies.

GOAL FOR AMPHIBIOUS LIFT

Requirements for amphibious ships are determined by the goal for amphibious lift--the ability to transport and support amphibious forces--

1. A forthcoming CBO study will address approaches to meeting needs for aircraft used in amphibious assaults.

which in turn is specified by the number of Marine Corps units or task forces to be transported. Three types of task forces represent the spectrum of military power that the Corps can assemble. The largest task force is a Marine Expeditionary Force (MEF), which consists of about 50,000 troops and would require about 55 amphibious ships to be transported. The middle-sized task force--a Marine Expeditionary Brigade (MEB)--has about 15,000 troops and would require about 20 amphibious ships. The smallest task force is the Marine Expeditionary Unit (MEU), which consists of about 1,900 troops and would require between three and five amphibious ships.

The current goal is to provide enough amphibious ships to transport simultaneously the assault echelon of a Marine Expeditionary Force and a Marine Expeditionary Brigade. The assault echelon is that part of the task force and its associated supplies that would be needed during the first 15 days of combat. The goal requires enough ships to move 50,000 troops as well as large quantities of vehicles, cargo, aircraft, and LCACs (landing craft, air cushion).

This goal for amphibious capability is much larger than what has been required in any assault since World War II. The landing at Inchon involved about 19,500 Marines, and a total force of about 25,000 troops. None of the five major events involving Marines since Inchon has required more than 1,700 troops in the initial landing that involved amphibious ships. Thus, the Administration's goal is best viewed as a desire to provide insurance against a military need that has arisen in the past, but not recently.

ADMINISTRATION PLAN

To meet its goal, the Administration plans to build three different types of amphibious vessels during the years 1990 through 1994. The most expensive are the large LHD-1 amphibious assault ships (the Wasp class), which carry helicopters and AV-8B Harrier "jump" jets and cost about $1 billion apiece. The Administration plans to procure two LHD-1 ships in the next five years. The Administration also plans to buy five LSD-41(CV) dock landing ships (the Whidbey Island class, cargo variant), which are designed to transport cargo and vehicles. Finally, the Administration would purchase 48 LCAC landing craft, which ferry vehicles, equipment, and troops from ship to shore. The

LCACs travel rapidly over the water on a cushion of air, rather than riding in the water like conventional vessels.

In addition to purchasing new amphibious ships, the Administration plans to keep older ships in the fleet until they reach 35 years of age. This retirement plan, combined with the planned new purchases of ships, would leave the United States with a fleet of 72 amphibious ships in 1998, when all the ships the Administration proposes to purchase during the 1990-1994 period would have been delivered.

Meeting the Goal

This fleet of 72 ships would meet or exceed the goals for amphibious lift in all categories except for helicopter deck spots, for which the shortfall would be only about 2 percent. Thus, the Administration plan is consistent with establishing and maintaining a large fleet of amphibious ships capable of a major amphibious assault. By 1998, the amphibious fleet would be able to transport a force that is twice the size of the one that landed at Inchon in 1950.

Having a large amphibious fleet would match policies supported by the Navy and Marine Corps. The services contend that the decline in the number of U.S. military bases overseas requires a large amphibious force, which can operate independently of overseas bases. They also believe that changes in tactics--such as attacking from over the horizon (25 to 50 miles offshore)--can help overcome threats posed by new technology, including those created by precision-guided weapons.

Keeping Ships for 35 Years

To meet the goal for amphibious lift with its current shipbuilding plan, the Administration must keep existing amphibious ships in service for 35 years. As recently as 1982, the Navy planned on retiring these ships after 30 years. If the Navy were to retire ships at 30 years, by 1998 it would fall well short of the goal for amphibious lift--meeting between 82 percent and 97 percent of the goals for troops, vehicles, cargo, and space aboard ship for aircraft and landing craft.

Older ships would, however, suffer some disadvantages. Some analysts believe they would require sharply higher operating and support costs, though statistical analysis of recent data on operating costs does not bear out this concern. More likely, older ships might require more extensive and costly overhauls or, if they do not receive extensive overhauls, they could be less ready than newer ships to perform their wartime missions. Perhaps most important, many older ships lack modern capabilities, such as newer weapons and communications gear, that the Marine Corps believes would be critical to successful completion of a major amphibious assault. In particular, some older ships are not well suited for amphibious assaults launched from over the horizon. Attacking from ships at a distance of about 25 to 50 miles from shore helps protect ships from attacks by shore-based forces armed with missiles.

Cost and Budgetary Pressures

Between 1990 and 1994, the procurement cost for all three types of vessels in the Administration plan would total $4.5 billion. The plan would also entail substantial operating costs--about $28 billion to pay for costs of operating the fleet of amphibious ships over the next 10 years.

The Administration's plan to spend $4.5 billion for procurement of amphibious ships is not unreasonable in view of past budget shares accorded to such vessels. Assuming no real growth in the total shipbuilding budget between 1991 and 1994, which seems reasonable in light of current pressure to hold down defense spending, the Administration's amphibious shipbuilding plan would consume about 8 percent of the total shipbuilding budget--about the same share it received between 1980 and 1989.

Yet it may be difficult to sustain this level of commitment in future years. The share available for procurement of amphibious ships might fall because other types of Navy ships seem likely to enjoy a higher priority for limited funding. These competing ships include Trident ballistic missile submarines, new aircraft carriers to replace those that will reach the end of their expected service lives in the late 1990s or early in the next century, SSN-21 submarines, and DDG-51 guided-missile destroyers.

ALTERNATIVES TO THE ADMINISTRATION PLAN

If funds available for the amphibious fleet shrink significantly, the Administration and the Congress will have to consider alternatives to the Administration plan. Pressures on the Navy's budget could force the service to choose between buying new amphibious ships and continuing to operate all older ones.

It is also possible that funds available for amphibious shipping might be slashed drastically by an Administration and a Congress seeking ways to hold down federal deficits. If so, the most realistic choice might be to reduce the goal for amphibious lift. Such a reduction in the goal would be consistent with the arguments of critics who contend that large amphibious assaults are obsolete.

This study examined three options that illustrate specific programs with each of these policy choices. Option 1 would retire some older amphibious ships early, but would buy new ships according to the Administration's plan; Option 2 would keep amphibious ships in the fleet until they reach the end of their expected service life, but would cancel procurement of two amphibious ships and seven landing craft; Option 3 would establish a reduced goal for amphibious lift, which could be met by canceling procurement of all new amphibious ships and 22 of the 48 landing craft from the Administration's plan.

Option 1: Reduce Operating and Support Costs Through Selective Retirements

Under Option 1, spending for new amphibious ships would remain unchanged from the Administration plan. To accommodate reduced funding, however, this option would retire some older amphibious ships in 1991, before the end of the 35-year service life planned by the Administration.

Option 1 leaves the decision of exactly which amphibious ships to retire up to the Navy. For the purpose of illustration, however, the option assumes the Navy retires 11 older ships that are not well suited to the over-the-horizon tactics now preferred by the Navy and the Marine Corps. These retirements would lead to a smaller force (63

ships in 1998 compared with 72 under the Administration plan), but one that would be more modern (see Summary Tables 1 and 2).

A primary advantage of this alternative is its reduced operating and support costs relative to the Administration plan. The amount of savings would depend on the type and number of ships that the Navy retires. If the Navy retired the 11 ships assumed here, then savings in operating and support costs for the smaller fleet would total about $1.2 billion between 1991 and 1994, and would average $200 million per year by 1998. The smaller fleet might also permit reductions in overhaul costs that are not reflected here. Furthermore, if the Navy retires older, less capable ships, then the resulting amphibious fleet would be more homogeneous, which could reduce some tactical difficulties associated with having a fleet comprising ships of many different types and ages. Finally, a smaller, more modern fleet may also increase the readiness of the amphibious fleet to go to war.

SUMMARY TABLE 1. DESCRIPTION OF THE ADMINISTRATION PLAN AND ALTERNATIVES

	Number of Ships Purchased, 1990-1994		Assumed Age of Ships at Retirement (Years)	Number of Amphibious Ships in 1998
	Major Ships	LCAC Landing Craft		
Administration Plan	7	48	35	72
Option 1: Reduce Operating and Support Costs Through Selective Retirements	7	48	Varies, possibly less than 35	63
Option 2: Reduce Procurement Costs	5	41	35	70
Option 3: Reduce Goal	0	26	30	55

SOURCE: Congressional Budget Office.

The main disadvantage of this option is that it precludes the Administration from achieving its goal for amphibious lift during the 1990s. In 1998, the Navy would meet between 83 percent and 103 percent of its goals for transporting troops, vehicles, cargo, helicopters, and LCACs. Thus, the smaller amphibious fleet under this option increases the risk that the Navy would not have enough amphibious ships to mount a very large amphibious assault.

Option 2: Reduce Procurement Costs

If the size of the fleet is a key goal but funding for the amphibious fleet must still be reduced, then the Navy could reduce its planned purchases of new amphibious ships and LCACs while continuing to operate all older amphibious vessels until they reach 35 years of age. Under Option 2, spending for procurement of amphibious ships and LCAC landing craft would receive about 6 percent of the Navy's shipbuilding budget, the average share that they have received during the

SUMMARY TABLE 2. EFFECTS OF THE ADMINISTRATION PLAN AND ALTERNATIVES ON SELECTED MEASURES OF COST AND CAPABILITY

	Ships in 1998			Percentage of Goal Met by 1998		Cost Savings Relative to Administration Plan (Billions of dollars)		
							Operating and Support	
	Number	Average Age (Years)	Percentage 30 Years or Over	Current	Reduced	Procurement	1990-1994	1990-2000
Administration Plan	72	21.6	14	98-103	n.a.	n.a.	n.a.	n.a.
Option 1: Reduce Operating and Support Costs	63	20.6	14	83-103	n.a.	0.0	1.2	2.7
Option 2: Reduce Procurement Costs	70	22.2	14	91-98	n.a.	1.4	0.0	0.6
Option 3: Reduce Goal	55	22.3	0	66-79	103-129	3.6	0.6	4.2

SOURCE: Congressional Budget Office based on Department of the Navy data.

NOTE: n.a. = not applicable.

period between 1950 and 1989, rather than the 8 percent they would receive under the Administration plan.

To accommodate this reduced funding, the option cancels plans to purchase one of the two LHD-1 amphibious assault ships, one of the five LSD-41(CV) dock landing ships, and seven of the 48 LCAC landing craft in the Administration plan. These reductions would result in an amphibious warfare fleet of 70 ships in 1998, nearly the same as the 72 ships in the Administration plan and larger than the 63 ships in Option 1 (see Summary Tables 1 and 2).

In contrast to Option 1, which reduces operating and support costs, Option 2 reduces procurement costs. Over the next five years, procurement savings under this option would amount to $1.4 billion, compared with savings of $1.2 billion in operating costs under Option 1. Because the amphibious warfare fleet is almost exactly the same size under the Administration's plan, savings in operating and support costs are small. Option 1, on the other hand, should result in continued reductions in operating costs throughout the 1990s.

In addition to saving procurement dollars, Option 2 would come close to meeting the current goal for amphibious lift. Between 91 percent and 98 percent of the goal for the different lift categories would be met in 1998. By keeping a larger amphibious fleet, this option limits the risk that the United States would not have enough ships to conduct a very large amphibious assault.

Retaining all amphibious ships in the fleet for 35 years, however, could increase overhaul costs or decrease readiness. Also, some of the older ships would not have the newer technologies that may be critical to the success of a large amphibious assault.

Option 3: Reduce Goal for Amphibious Lift and Retire Ships after 30 Years

Procurement budgets for amphibious ships might face even sharper reductions in funding over the next five years than were assumed in Option 2. Such a sharp reduction in funding could probably not be accommodated without a reduction in the goal for amphibious lift.

Option 3 adopts today's amphibious lift capability as a new, reduced goal for amphibious lift. The Navy can currently transport the assault echelon of one Marine Expeditionary Brigade (about 12,230 troops) on each coast, plus a small additional force. This option establishes a new goal of providing amphibious lift for the assault echelons of two Marine Expeditionary Brigades (one on each coast) plus an additional 15 percent of lift capability on each coast--or 2.30 Marine Expeditionary Brigades. The extra 15 percent on each coast allows for ships that might be unavailable because of ongoing repairs or other problems and thus should permit the Navy to move a brigade on each coast without a long period of advance warning.

Even if older amphibious ships are retired after 30 years, this new goal could be met through 1998 without procuring any large amphibious ships during the next five years. Procurement of LCAC landing craft could be reduced to 26 vessels through 1994 because fewer LCAC well-deck spots would be available in the smaller fleet. Five years without budget authority for procurement of any large new amphibious ships would not be without historical precedent; in the 40 years between 1950 and 1989, no procurement occurred in 16 years. Of course, this procurement holiday could not last forever. After 1998, amphibious lift would begin to decline below the goal of 2.30 Marine Expeditionary Brigades unless changes were made. The service life of existing ships could be extended beyond 30 years, for example, or new amphibious ships could be authorized after 1994.

Advantage: Cheaper Force With Today's Capability. This option would produce substantially higher cost savings than the other options. Compared with the Administration plan, savings achieved by canceling the procurement of new amphibious ships and landing craft total $3.6 billion, a reduction of about 80 percent. In addition, the savings associated with lower operating and support costs from the smaller fleet would total $600 million between 1990 and 1994 and would eventually amount to $700 million a year. Operating costs would total only about 85 percent of those under the Administration plan.

Because ships would be retired after 30 years, the fleet under this option would have fewer older vessels than in the Administration plan. This could be an advantage to the extent that an attacking force may be only as capable as its least capable ship.

Would this option provide the United States with enough amphibious lift? Yes, according to the history of the last four decades. No amphibious operation since World War II has involved more troops than could be transported under this option, and most landings have involved substantially fewer. Yes, also, according to those defense experts who argue that large amphibious assaults are militarily obsolete. These critics argue that precision-guided weapons would threaten amphibious ships and the landing craft and helicopters that would ferry troops and equipment from ship to shore. Along with improved surveillance that would make it difficult to surprise a capable enemy, these modern weapons would mean that a large amphibious assault could not be carried out without unacceptable losses. Only smaller assaults against less well-informed and less well-equipped foes are likely to be executed. If the United States is not likely ever to mount a large amphibious assault, then the minimal investment in amphibious ships under this alternative would be appropriate.

Disadvantage: Sharply Smaller Force. This option, however, would result in a fleet of 55 amphibious warfare ships in 1998, rather than 63 under Option 1, 70 under Option 2, and 72 under the Administration plan. Although this smaller fleet would meet the reduced goal established in this option, by 1998 it could meet only between 66 percent and 79 percent of the current goal. Thus, Option 3 would mean abandoning the notion of a very large amphibious assault of the sort conducted during World War II or at Inchon in 1950.

Moreover, for at least five years, this option would halt the procurement of modern amphibious warfare ships, which would make available fewer highly capable ships to conduct assaults from over the horizon.

CHAPTER I

INTRODUCTION

The Navy currently operates a fleet of 63 amphibious warfare ships. These vessels were designed from the keel up to transport U.S. Marine Corps troops, aircraft, and equipment, and to provide the capability of attacking enemy positions on land using weapons based at sea. The Navy and the Marine Corps provide the United States with an ability to project combat power from ship to shore that is unmatched by any other country.

Proponents of this capability argue that such mobile forces will be in great demand in coming years and decades. The United States may have difficulty maintaining military bases overseas, which would place a premium on amphibious forces and other military forces that do not depend on foreign-based facilities. Proponents also note that new tactics and equipment will help ensure the success of future amphibious assaults.

Critics argue, however, that large amphibious assaults are militarily obsolete. Long-range missiles make it difficult to come near a defended beach without encountering withering enemy fire, and satellites and other reconnaissance assets make it difficult to exploit the element of surprise. In support of their arguments, critics note that the last large amphibious invasion occurred at Inchon during the Korean War.

Moreover, maintaining U.S. amphibious capability will be expensive. Most of the ships in today's amphibious fleet were built in groups, with the ships in each group built at about the same time. Over the next 15 to 17 years, about 53 amphibious ships will reach the end of their expected service life. Replacing those vessels with modern ships will require increased investment at a time when the defense budget as a whole may be constant or declining. Investments in amphibious ships must also compete for scarce funds with other high-priority shipbuilding programs, including new ballistic missile submarines to enhance nuclear deterrence, new attack submarines to counter recent

advances in Soviet submarines, and additional aircraft carriers to maintain another important source of mobile military capability.

Nor are ships the only expense involved in maintaining U.S. amphibious capability. Amphibious landings today rely heavily on helicopters and aircraft to transport troops and equipment to shore and to support those forces, and maintaining and modernizing Marine Corps aircraft could add substantially to costs. This study, which focuses on the Administration's plan to buy amphibious warfare ships between 1990 and 1994, is the first of two publications by the Congressional Budget Office that address future costs for equipping and supporting the Marine Corps. A forthcoming study will address the Marine Corps' aircraft requirements.

The large bill for maintaining amphibious capability could come due during a period of easing of East/West tensions. Amphibious ships themselves are not covered by any of the proposals for reducing conventional arms that have been made to date, but a significant easing of tensions would increase pressure to reduce most types of defense spending, including spending on amphibious shipping.

Clearly, the Congress will have to make difficult choices about the level of investment to be made in amphibious ships. This study discusses the issues the Congress must face in making those choices and describes alternative solutions.

CHAPTER II

MARINE CORPS MISSIONS AND ORGANIZATION

The most important mission of the Marine Corps is amphibious assault. This chapter discusses that and other Marine Corps missions and also describes how the Corps is organized to carry them out.

AMPHIBIOUS ASSAULT

Amphibious assault--attacking land-based targets with troops, aircraft, combat vehicles, and equipment based at sea--is the Marine Corps' most important mission. Between World Wars I and II, the Corps' warfighting doctrine and training programs emphasized amphibious assaults. During World War II, the Corps became virtually synonymous with amphibious assaults, as it fought the island-hopping campaign against the Japanese in the Pacific Ocean. The Marine Corps' last major amphibious assault--at Inchon in 1950--is widely credited with turning the tide of the Korean War.

A Modern Amphibious Assault

A large, modern amphibious assault is one of the most complicated military missions. Because the United States has not conducted a large amphibious assault since 1950, the discussion of this mission is based on the Marine Corps' planning and training rather than on recent experience.

Getting to the Assault Area. Although the specific goal of each amphibious assault would be different, the general goal of all amphibious assaults is to build combat power ashore as quickly as possible. Marine Corps troops, vehicles, and equipment would be transported to the area of attack--referred to as the "amphibious objective area" or AOA--in Navy amphibious warfare ships. Depending on its scope, a modern amphibious assault would require anywhere from a few amphibious

ships to today's entire amphibious warfare fleet of 63 ships, plus other Navy warships.

For all larger assaults, amphibious ships would be accompanied by one or more aircraft carrier battle groups, and possibly by one or more battleship surface action groups.[1] The aircraft carrier battle groups are required because the Navy and Marine Corps believe that controlling the skies over the area of attack is essential if the amphibious assault is to succeed. The battleship surface action group's most important contribution is the 16-inch guns aboard the battleship, which could bombard the beach before the assault. Ships would be located as far away from the beach as possible to limit their vulnerability. Some ships would need to come within a few miles of the beach, while others could remain as far away as 100 miles or more.

Actions Prior to the Assault. Before the assault, the Marines would gather tactical intelligence about the AOA, perhaps from national intelligence assets such as satellites or reconnaissance aircraft. Information gathered by the amphibious task force itself would also be important. For example, reconnaissance teams might be sent ashore before the assault to search for concentrations of enemy forces and to note the presence of minefields and obstacles.

Fighter aircraft from the aircraft carriers would gain control of the skies over the area of attack. Attack aircraft from the carrier might bomb enemy targets that could threaten the assault, or they might attack targets far from the assault in order to deceive the enemy about the true location of the landing. Guns aboard the battleships, cruisers, and destroyers could perform similar missions.

Also before the assault, the commander of the landing force would determine the order in which troops and equipment land on the shore. The commander has troops trained to perform different tasks, many different types of equipment--including tanks, light armored vehicles, jeeps, artillery pieces and the trucks that tow them--and different types of ammunition. The cargo and vehicle storage areas of amphibious

1. An aircraft carrier battle group consists of an aircraft carrier, its air wing, and about six cruisers and destroyers. A battleship surface action group consists of a battleship and about four cruisers and destroyers.

ships can be arranged to make the loading of landing craft and helicopters as smooth as possible during the assault.

The Assault. Some troops, vehicles, and equipment would be carried ashore in helicopters based on amphibious ships. Landing craft--small boats designed to ferry heavy vehicles, artillery, and other equipment from ship to shore--would carry all equipment not carried by helicopters and would also be launched from amphibious ships. The commander would determine the proportion of equipment to be carried by helicopter and landing craft, depending on the objectives of the operation and the situation the Marines would face once they landed.

Marines might also travel from ship to shore in assault amphibian vehicles (AAVs)--armored personnel carriers that can travel in water and on land. Some amphibious ships are designated carriers for AAVs, which can be discharged from the stern of the ship while it is steaming. AAVs can accommodate about 20 combat-ready troops.

One of the primary challenges of a modern amphibious assault would be to coordinate the launching of helicopters and landing craft so that each reaches the shore at the appropriate time. Each type of helicopter and landing craft travels at a different speed and could be launched from ships at varying distances from shore. Yet landing on the shore at exactly the right time is critical for the success of the assault. For example, Navy forces might bombard the beach just before the initial force lands. If the force lands early, it might come under attack from friendly fire. If the force lands late, an enemy might have time to regroup following the shore bombardment.

Upon reaching the shore, landing craft would beach themselves, so that vehicles and equipment could be rolled off a ramp at the bow directly on the beach or in the surf close to the beach. Helicopters would land to discharge troops and equipment.

Aircraft, attack helicopters, and artillery transported by the task force would attack enemy forces that are located close to the Marines. Marine Corps pilots fly AH-1 Sea Cobra helicopters, F/A-18 Hornet

jets, and AV-8B Harrier "jump" jets to perform this mission.[2] Artillery that has been brought ashore could also be directed with precision at nearby concentrations of enemy forces and equipment.

The exact mission of the troops once they have landed would depend on the objectives of the operation. In many battles during World War II, for example, the Marine Corps' objective was to seize an entire island. In future conflicts, the objectives could range from destroying targets and then retreating, to securing land for an indefinite period of time.

After securing their initial positions, troops would begin to build logistics and supply stations on the beach. For example, amphibious task forces are deployed with equipment that converts sea water to drinking water and with tanks and piping to store and pump fuel.

Arguments Against Maintaining Amphibious Assault Capability

Amphibious assault is the Marine Corps' most important mission. Yet critics of that mission argue that the United States should not devote its scarce defense resources to maintaining the capability to conduct amphibious assaults because changes in technology have made assaults against defended beaches impossible to carry out successfully. The two technologies mentioned most frequently are precision-guided munitions (PGMs) and satellite reconnaissance.

Threats from New Technology. Precision-guided munitions are missiles and other weapons systems that are guided to their targets by radar, lasers, heat, or a video link between the weapon and its shooter. The development and spread of such weapons has been one of the most fundamental changes in warfighting in recent years. Dozens of countries, including many considered to be at a lesser stage of development, possess PGMs.

2. AV-8B Harriers can take off vertically like a helicopter or from a short roll on the flight deck of amphibious warfare ships, runways, portable airfields, and some roads. Harriers are the only fixed-wing aircraft that can take off from amphibious ships. F/A-18s must operate from aircraft carriers or airfields.

These munitions pose a variety of threats to the traditional amphibious assault. Antiship missiles--which could be launched from shore-based missile batteries, aircraft, ships, or submarines--threaten the Navy ships that would bring the Marines close to the beach. The range of some antiship cruise missiles is tens of kilometers. Under almost all planning scenarios, some Navy ships would have to come within this range during an amphibious assault and would therefore become vulnerable to these weapons.

The Navy's recent experience in the Persian Gulf adds credibility to concerns about PGMs. The USS Stark was struck by two Exocet antiship missiles in the gulf in May 1987. Although the warhead of one of these PGMs did not detonate, the attack killed 37 crewmen and created a fire that proved extremely difficult to control. The ship could not have carried on in its wartime role after being hit. According to several reports, only the heroic efforts of the Stark's crew and the aid of nearby ships prevented the Stark from being a complete loss. This incident validates the conventional wisdom that the best defense against PGMs is to avoid getting hit in the first place. This being the case, the Navy may be reluctant to bring ships within the range of PGMs, which would almost certainly be necessary during some stage of a large amphibious assault.

Precision-guided munitions also threaten Marine Corps forces as they travel from ship to shore in helicopters and landing craft. Current generations of landing craft and assault amphibian vehicles move slowly through water--about 12 knots for landing craft, 8 knots for assault amphibian vehicles. They are easily spotted because of their noticeable wake and have only limited means of defending themselves while in transit. (Assault amphibian vehicles are somewhat protected because much of the vehicle is submerged below the surface during transit.) The new generation of landing craft, the LCAC (landing craft, air cushion), moves at about 40 knots and so spends less time in vulnerable areas. But it too has no means of defending itself aside from its speed, and some critics maintain that it is especially vulnerable to enemy fire. Marines would also be transported in helicopters, which, as the war in Afghanistan made clear, are vulnerable to attack by precision-guided munitions.[3]

3. According to press reports, Mujahadeen guerrillas in Afghanistan armed with PGMs shot down many Soviet helicopters in the final years of Soviet occupation.

23-055 O - 89 - 2

Satellite reconnaissance is another technology that has led critics to question the wisdom of conducting an amphibious assault. A successful amphibious assault requires that the Marine Corps build up combat power ashore faster than an opponent can marshal forces to resist the attack. If the Corps can surprise an adversary and land where they are not expected, the chances of success are increased. With the advent of satellite reconnaissance, the Marine Corps' ability to surprise opponents may be reduced considerably. An opponent may know where a large amphibious task force is located and where it is headed long before the assault begins.

The importance of PGMs and satellite reconnaissance in any particular battle will depend on whether the opposing force has access to these technologies. While dozens of countries possess PGMs, few have satellite reconnaissance capabilities. Of course, adversaries that do not have satellites might nevertheless be given information collected by their allies' satellites.

Threats from Mines. Recent experience in the Persian Gulf also highlights a more traditional threat to an amphibious force: mine warfare. During an amphibious assault, mine warfare heavily favors the defending force. Mines are relatively inexpensive weapons and can be deployed in large numbers. For the assault force, however, clearing the mines can be an expensive, labor-intensive, time-consuming, and dangerous task.

Mining presents a threat not only to Navy ships but, perhaps more important, to assault amphibian vehicles and landing craft. During the transit from ship to shore, these craft are vulnerable to mines--especially once they reach shallow water--because, according to press reports, the Navy and the Marine Corps do not have equipment that is highly effective for clearing mines in shallow water.

As underscored during recent Persian Gulf operations, the Navy has traditionally relied on its allies in the North Atlantic Treaty Organization (NATO) to perform most minesweeping operations during a war. In conflicts outside NATO, however, allied minesweepers might not be available, and the United States could find itself short of needed minesweeping capabilities. Most of the Navy's minesweepers are in the part-time forces of the Naval Reserve and hence cannot be deployed overseas with their reserve crews unless ordered to do so by

the President. In situations short of general war, Presidents have faced political constraints--both domestic and international--that limit their ability to mobilize the reserves.

Arguments for Maintaining Amphibious Assault Capability

Despite these concerns, the Navy and Marine Corps contend that it is important to maintain the capability to carry out amphibious assaults. The services and other supporters have put forth a number of arguments to counter the assertion that large amphibious forces are militarily obsolete. Indeed, proponents argue that such operations could be of great military utility.

In Congressional testimony, Department of the Navy officials have referred to the declining number of U.S. overseas bases as one argument for according a high priority to mobile forces, including amphibious forces. The number of nations in which the United States has overseas bases has declined from more than 100 at the end of World War II to fewer than 40 today. Navy officials argue that this decline places a higher priority on forces that do not depend heavily on overseas bases. In his posture statement for 1990, then Secretary of the Navy William Ball noted the declining number of U.S. overseas military bases and wrote that "future negotiations may reduce our access [to overseas bases] even further, and our recent Persian Gulf experience shows how sensitive nations can be to foreign military presence, and how military options are likely to be constrained to forces *independent* of bases ashore. These developments should cause us to reexamine the priority assigned to forces which can operate independent of base access and overflight rights."[4] Naval forces, including amphibious forces, are not as dependent on access to overseas bases as land-based troops and air power.

Marine Corps officials have stated in Congressional testimony their belief that the U.S. military is much more likely to become involved in conflicts with less-developed countries than in a major war in

---

4. Department of the Navy, *A Report by the Honorable William L. Ball III, Secretary of the Navy, on the Posture and Fiscal Years 1990-1991 Budget of the United States Navy and Marine Corps* (1989), p. I-3. Emphasis in the original.

Central Europe.[5] Planning to meet the challenges posed by regional conflicts, they argue, requires amphibious forces, which are well suited for such conflicts.

Some independent defense experts have also noted the importance of maintaining mobile forces, which would arguably include amphibious ships. In its January 1988 report to the Secretary of Defense, the Commission on Integrated Long-Term Strategy stated that " . . . the Pentagon must give preference to more mobile and versatile forces--forces that can deter aggression by their ability to respond rapidly and discriminately to a wide range of attacks."[6] The commission did not specifically assert the need for a large amphibious force, but amphibious forces fit this description well.

In response to the threat posed by precision-guided munitions and the advent of satellite reconnaissance, the Navy and Marine Corps have changed their tactics. The most important change is the Corps' effort to develop the capability to launch amphibious assaults from over the horizon (that is, from 25 to 50 miles offshore). Keeping Navy ships over the horizon helps to limit the threat from precision-guided munitions. Since PGMs require accurate information on the location of Navy ships in order to attack them, keeping ships far offshore makes targeting them more difficult.

The Marine Corps claims that over-the-horizon assault tactics can limit the usefulness of information provided by an enemy's satellite reconnaissance. According to Marine Corps planners, an amphibious task force located 400 nautical miles from shore will be able to launch an amphibious assault against any point along more than 1,000 miles of coastline within 24 hours. Marine Corps planners assume that an enemy force would have to concentrate its efforts to defeat an amphibious assault. The long stretch of coastline that the Marine Corps can threaten with over-the-horizon tactics means that only satellite reconnaissance that can be collected and processed just before an am-

5. Statement of A.M. Gray, Commandant, U.S. Marine Corps, before the Projection Forces and Regional Defense Subcommittee of the Senate Armed Services Committee, Washington, D.C., March 10, 1989, p. 3.

6. Department of Defense, Commission on Integrated Long-Term Strategy, *Discriminate Deterrence* (1988), p. 11.

phibious assault will let an enemy know the exact location of the Marines' landing.

In recent years, the Navy and the Marine Corps have invested in improvements in the speed of vehicles that move troops and equipment from ship to shore to reduce their vulnerability to PGMs and gunfire. These improvements have been concentrated in three programs: the LCAC landing craft, the advanced assault amphibian (AAA) program, and the MV-22 Osprey aircraft (which Secretary of Defense Dick Cheney recently recommended not be bought in order to hold down defense costs). Both the LCAC landing craft and the AAA are designed to replace earlier generations of waterborne craft, and both are much faster than their predecessors. While the LCAC's predecessors (LCU and LCM boats) travel at a maximum speed of about 12 knots, the LCAC's maximum speed is over 40 knots. One proposed design of the AAA would result in a craft capable of speeds of 25 knots, instead of the 8 knots achieved by the current generations of assault amphibian vehicles, which the AAA will replace early in the next century. Similar improvements may be possible for helicopters and aircraft. The CH-46 helicopter's maximum speed is about 140 knots; the MV-22 aircraft, which may eventually replace the CH-46, is designed to have a top speed of over 240 knots.

Are amphibious assaults militarily obsolete? This study can raise this question but cannot answer it. The answer, however, has important ramifications for defense planning and the defense budget. Strong support for modern amphibious assaults would argue for investment in new amphibious ships and aircraft for the Marine Corps. Doubts about the feasibility of modern amphibious assaults would lead one to reallocate resources away from the Navy's amphibious warfare programs and the Marine Corps.

OTHER MARINE CORPS MISSIONS

Although amphibious assault is the key Marine Corps mission, three others are also worth noting: maintaining peacetime presence, defending Norway, and deploying with equipment stored on the maritime prepositioning ships.

Peacetime Presence

The mission of maintaining peacetime presence, or "showing the flag," may be important politically because it makes friends and foes aware of U.S. military capability. Forces that are showing the flag in an area are also available quickly if there is a crisis.

These forces have been called on frequently to demonstrate U.S. interest in regional conflicts and to respond to crises. For example, amphibious forces were used in at least 71 of the 215 instances in which the United States used military forces for political objectives between 1946 and 1975.[7]

Defense of Norway

The Marine Corps would also help to defend Norway in the event of war between the Warsaw Pact and the NATO allies. Norway is the only country in which the Marine Corps has prepositioned equipment for use in time of war.

The Marines' commitment to Norway underscores the military importance of controlling the Norwegian Sea and airfields in Norway. Some planners assert that these sites would greatly affect the outcome of a conventional (nonnuclear) conflict with Warsaw Pact forces in Central Europe. To support such a war, the United States would have to transport vast amounts of equipment across the North Atlantic in convoys, as was done during World War II. Analysts generally assume that more than 95 percent of the military cargo to be transported from the United States to Europe during a major war would go by sea. If Warsaw Pact forces captured airfields located in northern Norway, it is argued, then their combat aircraft would be able to operate much closer to the North Atlantic and would therefore pose a greater threat to U.S. shipping. If Pact forces gained control over the Norwegian Sea or denied use of the sea to NATO naval forces--especially antisubmarine warfare forces--then enemy submarines and surface ships could also pose a greater threat to U.S. shipping than if they were "bottled up" closer to their home ports. According to proponents of this

---

7. Barry M. Blechman and Stephen S. Kaplan, *Force Without War* (Washington, D.C.: Brookings Institution, 1978), p. 43.

view, U.S. Marines in Norway would not only help defend that country against Warsaw Pact forces, but they would also limit, albeit indirectly, the vulnerability of convoys sailing from the United States to Europe.

The decision to commit Marine forces to Norway reflects the political importance of planning for the defense of NATO's "northern flank." Much discussion about defending NATO countries focuses on the "central front," the 800-kilometer border between West Germany and the countries of East Germany and Czechoslovakia. Some analysts argue that military planners' historical propensity to concentrate on the central front may weaken the bond between countries located on NATO's flanks--like Norway--and the rest of the alliance. From this perspective, the Marine Corps' commitment to Norway highlights the United States' commitment to all of NATO in the event of a European war, thereby reinforcing the unity of the alliance.

Maritime Prepositioning Ships

The Navy operates 13 maritime prepositioning ships (MPS). They are specially designed commercial-type ships that house tanks, howitzers, and other equipment plus the supplies needed to support about 15,000 Marines for 30 days of combat. These ships are intended to position weapons near areas where they might be needed in a crisis, while avoiding the political problems associated with storing the weapons at foreign bases. Civilian crews operate the MPS ships, which are based in the Indian Ocean, the Northwest Pacific, and the North Atlantic. The MPS program began operating in 1985, and no new MPS ships are under construction or currently contemplated by the Navy.

To deploy troops with equipment from MPS ships, the ships would steam to a port where they could be unloaded. Marines would then fly to the area to "marry up" with the equipment as it is unloaded. Unloading the ships, flying in the Marines, and readying the force for deployment would require about 10 days. The MPS ships must be unloaded in an area that is safe from enemy attack, as the ships cannot unload their cargo safely if they are under fire.

ORGANIZATION

Although the Marine Corps and the Navy are closely linked, the Marine Corps is a separate service within the Department of the Navy.[8] By law, the Marine Corps is responsible for "service with the fleet in the seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign." The Marine Corps is also charged with providing security detachments on Navy ships and at naval bases, developing tactics and equipment for amphibious operations, and performing "such other duties as the President may direct." The Navy builds and operates the amphibious warfare ships and landing craft that transport Marine Corps forces.

To carry out its various missions, the Marine Corps deploys troops and equipment in Marine air/ground task forces (MAGTFs). Each task force contains combat troops, aircraft, and logistics support. Senior military commanders can alter the mix of personnel and equipment in a task force to meet the objectives of a deployment, the size and capabilities of potential adversaries, and the weather and geography likely to be encountered. The two largest task forces are called Marine Expeditionary Forces and Marine Expeditionary Brigades; the smallest is a Marine Expeditionary Unit.

Marine Expeditionary Forces and Brigades

A Marine Expeditionary Force (MEF) consists of about 50,000 Marines. It also has a substantial number of weapons including tanks, light armored vehicles, howitzers, helicopters, and fighter and attack aircraft. About 55 amphibious ships would be required to transport a MEF (see Table 1).

The Marine Corps has three active MEFs: one based in Okinawa, Japan; one at Camp Pendleton, California; and one at Camp Lejeune, North Carolina. Upon mobilization, the role of the 44,000 selected Marine Corps reservists would be to form a unit about the size of one

8. The Department of the Navy is unique in the U.S. military establishment because it oversees two armed services: the Navy and the Marine Corps.

MEF or to augment active units. Although MEF headquarters are maintained in peacetime, MEFs are sufficiently large forces that they are not routinely deployed as units in peacetime.

A Marine Expeditionary Brigade (MEB) has about 15,000 Marines. About 20 amphibious ships would be required to transport a brigade. Notionally, there are nine MEBs in the active force structure,

TABLE 1. PERSONNEL AND SELECTED EQUIPMENT IN MARINE CORPS NOTIONAL TASK FORCES

	Marine Expeditionary Unit (MEU)	Marine Expeditionary Brigade (MEB)	Marine Expeditionary Force (MEF)
Troops[a]	1,900	15,000	50,000
Navy Ships[b]	3 to 5	About 20	About 55
Ground Combat Element	Battalion 5 Tanks 12 AAVs 8 155mm Howitzers 0 LAV	Regiment 17 Tanks 47 AAVs 30 155mm 36 LAV	Division 70 Tanks 208 AAVs 108 155mm 147 LAV
Air Combat Element	Composite Squadron 12 CH-46 Helicopters 4 CH-53A/D/E Helicopters 6 AV-8B Aircraft 0 F/A-18 Fighter Aircraft	Air Group 48 CH-46 40 CH-53A/D/E 40 AV-8B 24 F/A-18	Wing 60 CH-46 48 CH-53A/D/E 60 AV-8B 48 F/A-18
Combat Service Support	Support Element Engineers Maintenance Supply Medical	Brigade Support Group Engineers Maintenance Supply Medical	Force Support Group Engineers Maintenance Supply Medical

SOURCE: Congressional Budget Office based on data from the Department of the Navy and *Marine Corps 1987 Concepts and Issues* (Washington, D.C.: Headquarters, U.S. Marine Corps, 1987), pp. A-1 through A-3.

NOTES: The forces shown here are illustrative. A notional task force includes additional types of equipment and aircraft. AAV = assault amphibian vehicle; LAV = light armored vehicle.

a. Includes Marine Corps troops and some supporting Navy personnel.

b. Assault echelon only. Commercial ships would carry support for the assault follow-on echelon.

TABLE 2. DISTRIBUTION OF TROOPS AND EQUIPMENT AMONG THE ASSAULT ECHELON, THE ASSAULT FOLLOW-ON ECHELON, AND THE FLY-IN ECHELON IN MARINE CORPS TASK FORCES (In percent)

	Assault Echelon	Assault Follow-on Echelon	Fly-in Echelon
Troops	62	23	16
Vehicles	46	42	12
Cargo	26	57	17

SOURCE: Congressional Budget Office based on data in Department of the Navy, *Department of the Navy Long-Term Amphibious Lift Requirement and Optimum Ship Mix Study* (1983), p. 12.

NOTE: The assault echelon includes the troops and equipment needed to sustain the task force for an amphibious landing and the first 15 days of combat. The other two echelons carry enough supplies to support the task force for another 15 to 45 days.

although only six MEB headquarters are permanently staffed in peacetime. The brigades are occasionally assembled for exercises, and analysts usually plan wartime deployments with MEB-sized forces. The September 1950 landing at Inchon, Korea, was carried out by a force of about six battalions--roughly two brigades. During a war in Europe, the Marines would send a brigade to Norway. Thirty days of supplies and the equipment for one MEB are located in central Norway during peacetime.[9]

Marine Corps and Navy planners divide MEFs and MEBs into three parts or echelons. The assault echelon comprises the troops and equipment that would be needed to sustain the task force for an amphibious landing and the first 15 days of combat. It consists of about two-thirds of all troops in the task force and about half of all vehicles, but only one-quarter of needed cargo (see Table 2). The assault follow-on echelon and the fly-in echelon carry enough supplies to support the task force for an additional 15 to 45 days, after which the landing force would require further reinforcement.

9. According to Marine Corps plans, all of the equipment for this program will be fully in place later in 1989. Norway and other NATO allies paid for construction of the storage facilities, which are actually man-made caves. The United States bought the supplies and equipment.

Because the Navy does not possess enough amphibious ships to transport the entire Marine Corps, the two services must agree on what portion of the Corps' forces the Navy's amphibious ships will carry. They have agreed that amphibious warfare ships will carry the troops and equipment for the assault echelon only. Commercial cargo ships that are under charter to the Military Sealift Command would transport all of the equipment required by the assault follow-on echelon, and aircraft would transport the fly-in echelon.

Marine Expeditionary Units

A Marine Expeditionary Unit (MEU) is the smallest of the three Marine air/ground task forces. MEUs are made up of about 1,900 Marines and are transported on three to five amphibious ships. They have weapons, helicopters, and AV-8B attack jets, but no fighter aircraft. In contrast to the larger task forces, MEUs are deployed routinely in peacetime. Two MEUs are always forward deployed: one in the Mediterranean and one in the Western Pacific or Indian Ocean. These units form, train, deploy, and then disband to ensure rotations of people and equipment about every six months. Units on routine deployments rotated in and out of Lebanon for peacekeeping duties from 1982 to 1984. They have also been sent to respond to international crises and have been used on short notice for military operations. For example, a MEU participated in the military operations in Grenada in 1983.

Training for MEUs has recently been changed to improve their abilities to conduct special operations. The new training helps develop the ability to enter a foreign country, carry out a mission, and then exit--all in a very short time. Such operations might include the rescue of American hostages or selective retaliatory strikes against terrorist bases.

CHAPTER III

SHIPS AND THE CURRENT GOAL FOR AMPHIBIOUS LIFT

The Marine Corps gets where it needs to go by ship. The fleet of amphibious ships is designed to carry Marine Corps troops and various types of weapons and cargo--a capability referred to as amphibious lift. This chapter discusses the types of ships used by the Corps. It then addresses the Administration's current goal for ships to transport Marine Corps forces and assesses how closely that goal is met by today's fleet.

TYPES OF SHIPS IN TODAY'S AMPHIBIOUS FLEET

Ships that transport the Marines and their equipment are bought and operated by the U.S. Navy. The Navy's amphibious fleet includes 63 ships of different types, which are described in Appendix A. This section describes only those types that are most important to this study--namely, the ones in the Administration's shipbuilding plan for 1990 through 1994 (see Table 3). These types include:

- Amphibious assault ships. The LHD-1--referred to as the Wasp class--is a large vessel that provides a floating base for helicopters and aircraft and a dock for landing craft. Each of the 40,500-ton ships costs about $1 billion.

- Dock landing ships. The LSD-41(CV) cargo carrier--designated the Whidbey Island class--provides a floating dock for LCAC landing craft and carries many types of cargo needed during an amphibious assault. Each of the 17,000-ton ships costs about $250 million.

- LCAC landing craft. The LCAC (landing craft, air cushion) is a new type of landing craft that achieves speeds of up to 40 knots by rising out of the water and traveling on a cushion of air. It transports personnel and equipment from ship to shore. Each LCAC costs about $25 million.

The Navy is also designing a new amphibious assault ship known as the LX. The Navy plans to complete the LX's design in 1994 and to seek authorization of the first ship in 1996. If the schedule for the LX program is not delayed, the first ship would enter the fleet around the year 2001.

Because this study focuses on the five years (1990-1994) in the Administration's current shipbuilding plan, and because design of the LX is at such an early stage, the study does not address how the LX might fit into the shipbuilding plans of the late-1990s. The Navy, however, will continue to develop its design, and the Congress will undoubtedly face decisions regarding the design and procurement of the LX in the coming years. Appendix A discusses further the LX and technologies for new generations of amphibious warfare ships.

TABLE 3. AMPHIBIOUS SHIPS AND LANDING CRAFT IN THE ADMINISTRATION'S SHIPBUILDING PLAN FOR 1990 THROUGH 1994

Description/Class	Size (Tons)	Cost (Millions of dollars)	Major Missions
Amphibious Assault Ship (LHD-1 Wasp Class)	40,500	1,000	Floating base for helicopters and some aircraft. Cargo and vehicle storage.
Dock Landing Ship Cargo Variant (LSD-41 (CV) Whidbey Island Class)	17,000	250	Transport cargo and vehicles.
LCAC (Landing Craft, Air Cushion)	200	25	Transport vehicles, cargo, and troops from ship to shore.

SOURCE: Congressional Budget Office; and Norman Polmar, *The Ships and Aircraft of the U.S. Fleet* (Annapolis, Md.: Naval Institute Press, 1987).

GOAL FOR AMPHIBIOUS SHIPPING

The current goal for amphibious lift calls for the Navy to provide enough capacity in all amphibious ships to transport the assault echelon--that is, the initial fighting force--associated with one Marine Expeditionary Force and one Marine Expeditionary Brigade (a MEF and a MEB). To do this, the Navy has determined that it would require enough amphibious ships to transport 50,000 troops and varying amounts of vehicles, cargo, aircraft, and landing craft (see Table 4). The current goal for amphibious lift refers to the capacity of the entire amphibious fleet, even those ships that might be unavailable--a decision made within the Department of the Navy in 1982.

Even if this goal were reached, however, the Navy would find it difficult to deploy these two task forces simultaneously for two reasons. First, at any given time, some ships would be disassembled while undergoing repairs or long-term overhauls and could not be sent to sea until they were reassembled and readied for deployment, a task that could take weeks or months. During the 1970s, the Department of Defense assumed that about 15 percent of the entire fleet's amphibious lift capability would not be available at any one time, and factored this into its planning. Second, in peacetime, amphibious warfare ships are divided about equally between the East and West coasts--currently about 30 ships are based on each coast. In order for a Marine

TABLE 4. GOAL FOR AMPHIBIOUS LIFT FOR THE ASSAULT ECHELONS OF ONE MARINE EXPEDITIONARY FORCE AND ONE MARINE EXPEDITIONARY BRIGADE

50,000	Troops
1,077	Thousand Square Feet of Vehicle Storage
2,490	Thousand Cubic Feet of Cargo Storage
635	Helicopter Deck Spots (CH-46E Equivalents)
90	LCAC Well-Deck Spots

SOURCE: Department of the Navy, *Department of the Navy Long-Term Amphibious Lift Requirement and Optimum Ship Mix Study* (1983), pp. 6 and 30; and Department of the Navy data.

Expeditionary Force to assemble on one coast, about 25 ships would have to travel from the Atlantic to the Pacific, or vice versa, which could take several weeks, or perhaps months. The exact time would depend on where the ships, troops, and their equipment are located when called on to form the large unit.

Basis for Establishing the Goal

The goal for amphibious lift was established during the Reagan Administration. The specific requirements for meeting this goal were determined in the *Department of the Navy Long Term Amphibious Lift Requirement and Optimum Ship Mix Study* in 1983 and were modified slightly in 1987. The current Administration has not formally revised the goal.

The goal is described in terms of the space aboard ships for five items: troops, vehicles, cargo, aircraft, and LCAC landing craft.

Troops. Capacity is measured by the number of Marines the ships can carry in their normal berthing spaces. The current goal calls for enough ships to carry 50,000 troops. Ships can carry additional troops (about 10 percent more) for short periods of time if necessary.

Vehicles and Cargo. Capacity is measured in square footage. Vehicles for the assault echelons of the Marine Expeditionary Force and Brigade would require about 1.1 million square feet. In addition, this force would require about 2.5 million cubic feet of cargo to support it.

Aircraft. Capacity is measured in terms of "CH-46E-equivalent deck spots," the area that would be required if all aircraft spaces on ships were filled with CH-46E Sea Knight helicopters. Because not all aircraft are the same size as a CH-46E, each aircraft type is assigned a spotting factor, which expresses its size in terms of a CH-46E. For example, the Navy assigns CH-53E Sea Stallion helicopters a spotting factor of 1.88, indicating that each CH-53E takes up 88 percent more space than a CH-46E. When planners assign planes to ships, these factors help determine the number of aircraft of different types that ships can accommodate.

LCAC Landing Craft. Capacity is measured in the spots available in the well-decks of ships. Most classes of amphibious ships are equipped with well-decks--areas in the rear of the ship that open to the sea and can be flooded with water. Marines can load landing craft through ramps that lead from vehicle and cargo storage areas directly to the well-deck. Once loaded, landing craft can then depart out of the stern of the ship. Amphibious warfare ships carry up to four LCACs, depending on the ship's class.

Studies used to establish the goal for amphibious lift assume that the assault echelon of a Marine Corps force should be able to fight for 15 days without resupply. Thus, the goal seeks to transport the troops, vehicles, and cargo that would be required to seize territory and conduct follow-on operations for 15 days. Requirements are based on detailed assumptions about the kind of war that the Marines would be fighting.

The requirement for landing craft and aircraft spots, but not aircraft themselves, results from analyses that estimate the number of landing craft and aircraft that would be needed to transport the assault element--a small subset of the assault echelon that is required for initial operations--from ship to shore.[1] The Navy and the Marine Corps plan to transport the assault element to shore from ships located over the horizon (25 to 50 miles from shore) within 90 minutes of the first landing, with each landing craft or helicopter making no more than two round trips or sorties. Navy studies that determine the number of spots for helicopters and landing craft required for the assault echelons of the Marine Expeditionary Force and Brigade address two possible amphibious assaults: one in which two-thirds of the troops, vehicles, and equipment is transported inland, and one in which two-thirds of the force is transported to the beach. Landing two-thirds of the force inland demands the most helicopters; landing two-thirds of the force on the beach demands the most landing craft. The Navy and the Marine Corps determine one requirement for each by calculating the number of helicopters needed for the inland scenario and landing craft needed for the beach scenario.

1. The Marine Corps determines its requirements for aircraft based on the force structure of the entire Corps, not just the portion that can be transported at one time aboard Navy ships.

History of Changes in the Goal

Goals for amphibious lift have changed as planning assumptions have varied and as new equipment has entered the Marine Corps' inventory. For example, in 1983, when the Navy and Marine Corps first agreed on the current goal, planning assumptions led to a requirement for slightly less square footage for vehicles.

There have also been changes in the basic notion of the size of the force to be transported. During the Carter Administration, the Marine Corps sought the capability to transport one Marine Expeditionary Force plus the 15 percent additional capability to account for ships unavailable because of repair, overhaul, or other causes. The Carter Administration's goal resulted in requirements somewhat smaller than today's.

RECENT USES OF AMPHIBIOUS FORCES AND THE ADMINISTRATION'S GOAL

A different perspective on the appropriateness of this goal can be gained by assessing the numbers of Marine Corps forces that have actually been used since World War II. The current goal far exceeds that number.

The Marine Corps fought in the Korean and Vietnam Wars. But with the exception of the landing at Inchon, Marine forces did not conduct amphibious assaults. Rather, in combat they conducted ground operations similar to those carried out by many U.S. Army units. Amphibious warfare ships did not play a major role in these ground operations.

Amphibious ships have been used on many occasions since World War II, however, to land Marine Corps troops. Table 5 lists the number of Marine Corps troops initially landed ashore for combat or peacekeeping duties in six instances since World War II. In each of the operations since the initial landing of 19,500 Marines at Inchon, the initial landing force has ranged between 300 and 1,700 Marines. Amphibious warfare ships are most important for transporting and landing these initial forces. After the initial force has landed, more troops--usually many more than participated in the initial landing--

can be sent in. Troops that arrive later, however, do not necessarily need to be transported to the battle aboard amphibious ships. In the Dominican Republic, for example, the United States eventually deployed 23,000 troops, but only about 500 were landed initially with the aid of amphibious ships. Ultimately, only about 1,700 of these 23,000 troops were sent ashore from amphibious ships. In Lebanon in

TABLE 5. U.S. MARINE CORPS FORCES USED IN VARIOUS LANDINGS SINCE WORLD WAR II

Operation	Year	Troops in Initial Landing	
		Number	As Percentage of Current Goal
Inchon	1950	19,500[a]	39.0
Lebanon	1958	1,700[b]	3.4
Dominican Republic	1965	500[c]	1.0
Mayaguez Incident	1975	300[d]	0.6
Grenada	1983	500[e]	1.0
Lebanon	1982-1984	1,200[f]	2.4

SOURCES: Lynn Montross and Nicholas A. Canzona, *The Inchon-Seoul Operation* (Washington, D.C.: Historical Branch, Headquarters, U.S. Marine Corps, 1955); Barry M. Blechman and Stephen S. Kaplan, *Force Without War* (Washington, D.C.: Brookings Institution, 1978); J. Robert Moskin, *The Story of the U.S. Marine Corps* (New York: Paddington Press, 1979); J.M. Johnson, Jr., R.W. Austin, and D.A. Quinlan, "Rescue of the SS Mayaguez, 1975," in Merrill L. Bartlett, ed., *Assault from the Sea: Essays on the History of Amphibious Warfare* (Annapolis, Md.: Naval Institute Press, 1983); Benis Frank, *U.S. Marines in Lebanon, 1982-1984* (Washington, D.C.: History and Museum Division, Headquarters, U.S. Marine Corps, 1987); Ronald H. Spector, *U.S. Marines in Grenada, 1983* (Washington, D.C.: History and Museum Division, Headquarters, U.S. Marine Corps, 1987); *Washington Post*, various dates, October 1983; and Department of the Navy data.

a. Approximately 2,760 U.S. Army troops and 2,790 Republic of Korea Marines also participated in the assault.

b. Total U.S. forces in Lebanon in 1958 peaked at about 14,000--6,000 Marines and 8,000 Army troops--before they were withdrawn.

c. A force of about 500 Marines landed on April 28, 1965. Two days later, the force had grown to 1,700 Marines and 2,500 U.S. Army troops. Total U.S. forces peaked at about 23,000, about 6,000 of which were Marines.

d. Landing force on Koh Tang Island and troops used to seize the SS Mayaguez.

e. About 2,200 Army troops also participated in the initial landing. Forces on Grenada totaled about 6,000--500 Marines, 5,500 Army and support forces--several days after the operation began.

f. Different Marine Expeditionary Units rotated in and out of Lebanon for peacekeeping duties. Approximately 800 Marines went ashore to serve as part of a multinational peacekeeping force in 1982, and subsequently withdrew. A force of about 1,200 Marines returned to Beirut 19 days later.

1958, Marine Corps forces landed by sea and took control of the Beirut airport, which enabled follow-on units to fly in.

The landings conducted since Inchon were accomplished with far fewer ships than the Administration's goal envisions. In almost all of the operations cited in Table 5, the Marine Corps' forces used in the initial landing were units embarked on amphibious ships during routine deployments of the smaller task forces called Marine Expeditionary Units. Therefore, as long as the Navy has enough amphibious warfare ships to support the routine deployments of these smaller units, the United States would be able to respond to most of the types of contingencies for which the Marines have been sent ashore since World War II. A common analytic assumption is that three ships are required to keep one forward deployed. Thus, a minimal force of about 40 amphibious ships would probably support routine deployments of one Marine Expeditionary Unit from each coast, plus a part-time deployment of a third and smaller Marine task force in the Pacific, which is current practice. Meeting the Administration's goal would require a fleet of about 75 ships.

History does not, however, provide conclusive evidence that the Administration's goal is unwarranted. One buys a large military, including a large amphibious force, to deter potential aggressors and to insure against the unexpected. And the unexpected sometimes occurs. In testimony before the Congress in 1949, General Omar Bradley, then Chairman of the Joint Chiefs of Staff, stated that he did not expect that the United States would ever again conduct a large amphibious landing. Less than one year later, the Navy and Marine Corps conducted a large, and important, amphibious landing at Inchon.

Moreover, the Marine Corps believes that the current goal does not represent what would be needed to accomplish today's war plans with minimal risk. In Congressional testimony, Marine Corps officials have stated that, based on assessments by the Unified Commanders who would command amphibious forces during wartime, the Marines need amphibious lift for two Marine Expeditionary Forces--one for each coast.[2]

---

2. Statement of A.M. Gray, Commandant, U.S. Marine Corps, before the Projection Forces and Regional Defense Subcommittee of the Senate Armed Services Committee, Washington, D.C., April 14, 1988, p. 3.

PROGRESS TOWARD MEETING THE CURRENT GOAL

Today the Marine Corps could meet only a part of its current goal for amphibious lift. It could transport about 88 percent of all the troops associated with the assault echelons of a Marine Expeditionary Force and Brigade, but only about 56 percent of the LCAC landing craft. The capability to transport vehicles, cargo, and helicopters falls between these two percentages.

The ability to meet the current goal will improve in the next few years. In recent years, the United States has bought ships that will help meet amphibious needs. About four years elapse between the time the Congress authorizes purchase of an amphibious ship and the vessel is delivered. But by 1994, when all ships purchased through 1989 have entered the fleet, the Marine Corps will be able to meet between 88 percent and 103 percent of its current goal for various categories of amphibious lift.

To meet 100 percent of the current goal in all categories, however, the Navy will have to procure more ships and delay the retirement of older vessels. As the next chapter shows, the Administration plans to do just that.

CHAPTER IV

ADMINISTRATION PLAN FOR AMPHIBIOUS LIFT

The Bush Administration has submitted to the Congress a budget plan for increasing and modernizing U.S. capability to transport Marine Corps troops, weapons, and other equipment. This chapter analyzes that plan and assesses its ability to meet the current goal for amphibious lift.

The Administration plan offers some important advantages. By 1998, it would meet essentially the entire current goal for amphibious lift. Moreover, the plan would meet the goal without devoting a larger share of shipbuilding resources to amphibious shipping than these ships received in the 1980s.

The Administration plan assumes, however, that older amphibious ships are maintained in the fleet until they reach 35 years of age. Thus, the fleet would become older, and many vessels would lack the latest technology that may be crucial to a successful amphibious assault. Moreover, while the share of shipbuilding resources for amphibious ships does not grow under the Administration plan, neither does it decrease, and there may be pressure to reduce funding for amphibious ships below the Administration's proposed level to accommodate reductions in the overall defense budget or to provide funds to build ships of higher priority.

THE PLAN AND ITS COST

The Bush Administration's five-year shipbuilding plan for 1990 through 1994 includes funds for two of the large amphibious assault ships (LHD-1 Wasp class) that provide floating platforms for the aircraft and helicopters needed in an amphibious assault. One would be bought in 1991 and one in 1993. The plan also calls for the purchase of five of the cargo variants of the dock landing ships (LSD-41(CV) Whidbey Island class). One of these would be bought each year. These vessels ferry cargo, vehicles, and troops. In addition, the Administra-

tion would purchase 48 LCAC landing craft that provide high-speed transportation of personnel, vehicles, and equipment from ship to shore. There would be 9 LCACs purchased in 1990, 12 in 1991, and 9 in each of the following three years. The Bush Administration's plan for procuring amphibious warfare ships and LCACs over the next five years is shown in Table 6.

TABLE 6. PROCUREMENT OF AMPHIBIOUS WARFARE SHIPS AND LANDING CRAFT IN THE ADMINISTRATION'S SHIPBUILDING PLAN FOR 1990 THROUGH 1994

	1990	1991	1992	1993	1994	Total 1990-1994
			Quantity			
Amphibious Assault Ship (LHD-1 Wasp Class)	0	1	0	1	0	2
Dock Landing Ship Cargo Variant (LSD-41 (CV) Whidbey Island Class)	1	1	1	1	1	5
LCAC (Landing Craft, Air Cushion)	9	12	9	9	9	48
			Cost (In billions of 1990 dollars)			
Amphibious Assault Ship (LHD-1 Wasp Class)	a	1.0	0.1	0.9	0.1	2.0
Dock Landing Ship Cargo Variant (LSD-41 (CV) Whidbey Island Class)	0.2	0.2	0.2	0.3	0.3	1.2
LCAC (Landing Craft, Air Cushion)	0.2	0.3	0.2	0.2	0.2	1.2
Total Cost	0.5	1.5	0.5	1.4	0.6	4.5

SOURCE: Congressional Budget Office based on Department of the Navy data.

a. Less than $50 million.

Although not formally part of the budget, another important part of the Administration plan involves the age at which older vessels are retired. The Administration currently assumes that all amphibious vessels can be operated until they are 35 years old. This represents a change in assumptions. As recently as 1982, the Navy planned on retiring ships at the age of 30 years.

These plans for new construction of ships and for later retirement of older ships would leave the United States with 72 amphibious ships by 1998, the first year when all the ships purchased over the next five years would be in the fleet. This fleet would be larger than today's level of 63 ships but would also be older.

Construction of amphibious ships and LCACs would cost a total of $4.5 billion over the next five years. This amount represents a modest real decrease from spending in recent years. When expressed in 1990 dollars, spending for amphibious ships and LCACs between 1985 and 1989 totaled about $4.8 billion.

Total operating costs for the amphibious fleet would amount to about $2.6 billion a year. These costs include those for personnel assigned to the ship and for day-to-day operating costs, as well as some indirect costs for operating naval bases, training, medical care, and other support activities.

MEETING THE CURRENT GOAL

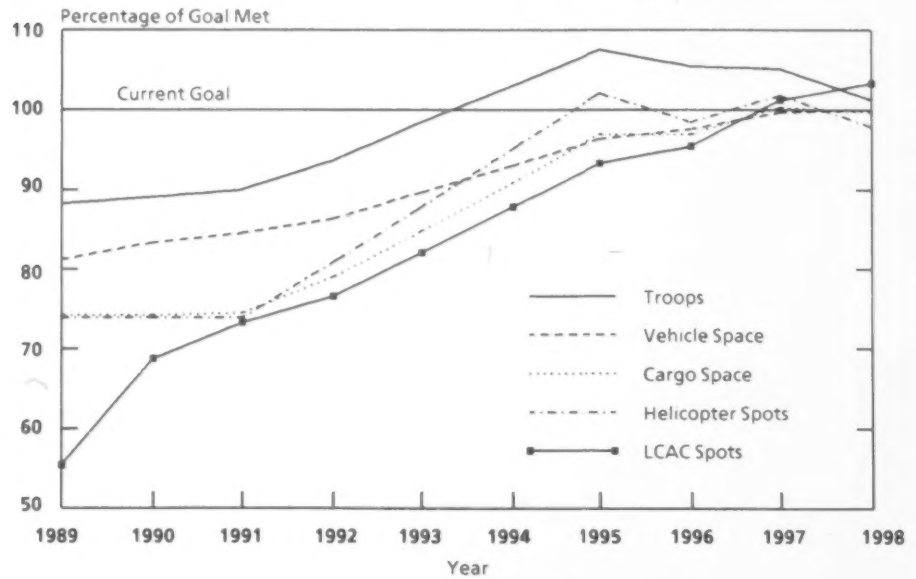
To supporters of a large amphibious force, a key advantage of the Administration plan is that it would meet almost the entire current goal for amphibious lift. According to CBO projections, by 1998 the Navy would have enough amphibious ships to meet the current goal for all but one category of lift (see Figure 1). That category--helicopter deck spots--would miss the goal by only 2 percent. Indeed, some categories of amphibious capability would actually exceed the goal. Well-deck spots for LCAC landing vehicles, for example, would equal 103 percent of the current goal because the ships needed to meet other capabilities would provide slightly more than enough spots for landing vehicles. (Appendix B discusses the funding that would be required to sustain the fleet at the current goal beyond 1998.)

Thus, the Administration plan is consistent with establishing and maintaining a large fleet of amphibious ships that are capable of a major amphibious assault. Indeed, if the United States ever mounted an amphibious assault using all of the ships available under the Administration plan, it would be the largest assault since the battle for Okinawa during World War II and would substantially exceed the force employed during the last major amphibious assault at Inchon in 1950. That landing involved only about half the total forces that would be available under the Administration plan.

RETAINING SHIPS FOR 35 YEARS

The Administration plan succeeds in meeting the goal for amphibious lift at a cost that is slightly below the real level of spending provided

Figure 1.
Amphibious Lift Capability Under the Administration Plan



SOURCE: Congressional Budget Office based on Department of the Navy data.

NOTE: The current goal is to provide enough capacity aboard amphibious ships to transport the assault echelons of one Marine Expeditionary Force and one Marine Expeditionary Brigade.

for amphibious ships during the previous five years (1985-1989). It does so largely because the Administration assumes that all amphibious ships can be kept in the fleet for 35 years rather than 30 years. But is the Navy plan to retain these vessels in the fleet until the age of 35 years reasonable?

Effects of Retirement Age on Goals and Costs

To answer this question, one must consider the effects of returning to a policy of retiring amphibious ships after only 30 years of service. If the Administration retired amphibious ships after 30 years, but still bought the same number of new vessels called for in its shipbuilding plan, then it would fall short of the current goal for amphibious lift. By 1998, amphibious ships could meet only between 82 percent and 97 percent of requirements for various categories of troops, equipment, and cargo (see Figure 2). Retirement at 30 years would therefore reverse a key advantage of the Administration plan--its ability to meet the current goal for amphibious lift.

Alternatively, if the Administration decided to meet every category of the current goal but still retire ships after 30 years of service, then shipbuilding costs would be much higher. Over the next five years, the Navy would have to spend about $9.4 billion on new amphibious ships and LCACs--more than twice the level proposed by the Administration (see Table 7). In a period of tight defense budgets, this alternative seems highly unlikely.

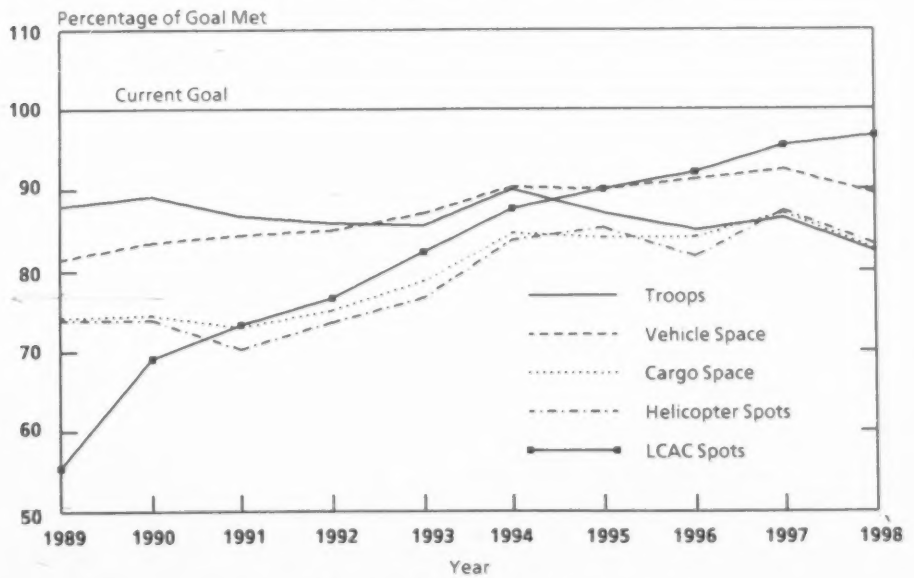
The desirability of the Administration's plan depends critically, therefore, on retaining ships until they have completed 35 years rather than 30 years of service. Several arguments are raised, however, against keeping ships in the fleet this long. Unless changes are made in the goal for amphibious lift, keeping ships longer merely delays the need to replace large numbers of amphibious ships. Keeping them longer could also result in higher costs for operations or overhauls or, if costs are held down, ships may be less ready to perform their wartime mission. Finally, keeping older ships means that many amphibious ships would not have the modern capabilities that may be critical to the success of a major amphibious assault.

Delaying the Need to Replace Large Numbers of Ships

Does a plan for retirement at 35 years simply put off the problem of having to replace a large number of ships? The answer is yes--but putting off the problem may not be unreasonable.

During the 1950s and 1960s, the Navy built amphibious warfare ships in groups, and many of the ships in each group will reach the end of their expected service life at about the same time. If the Navy retired ships after 30 years of service, then 53 of the current total of 63 amphibious ships would have to retire before 2002. This phenomenon of numerous retirements in a short period of time is commonly referred to as block obsolescence.

Figure 2.
Amphibious Lift Capability Assuming 30-Year Service Life and the Administration's 1990-1994 Shipbuilding Plan



SOURCE: Congressional Budget Office based on Department of the Navy data.

NOTE: The current goal is to provide enough capacity aboard amphibious ships to transport the assault echelons of one Marine Expeditionary Force and one Marine Expeditionary Brigade.

Under current plans to retire ships after 35 years, only 13 of the 63 current amphibious ships would have to retire by 2002. But, of course, the 35-year rule would simply delay the day of reckoning, and a large number of retirements would occur soon after 2002. Thus, if the United States wants to maintain a large amphibious fleet, delaying retirement ages may simply be postponing an expensive problem.

TABLE 7. PROCUREMENT REQUIRED TO MEET THE CURRENT GOAL FOR AMPHIBIOUS LIFT BY 1998 IF SHIPS ARE RETIRED AT 30 YEARS

	1990	1991	1992	1993	1994	Total 1990-1994
Quantity						
Amphibious Assault Ship (LHD-1 Wasp Class)	1	1	1	2	1	6
Dock Landing Ship Cargo Variant (LSD-41 (CV) Whidbey Island Class)	1	2	2	2	1	8
LCAC (Landing Craft, Air Cushion)	9	12	12	12	11	56
Cost (In billions of 1990 dollars)						
Amphibious Assault Ship (LHD-1 Wasp Class)	1.0	1.0	1.0	2.0	1.0	6.0
Dock Landing Ship Cargo Variant (LSD-41 (CV) Whidbey Island Class)	0.3	0.5	0.5	0.5	0.3	2.0
LCAC (Landing Craft, Air Cushion)	0.2	0.3	0.3	0.3	0.3	1.4
Total Cost						9.4

SOURCE: Congressional Budget Office based on Department of the Navy data.

While this delay may seem undesirable from a planning perspective, it may be reasonable in view of current world events. The next few years could feature major changes in geopolitics that might alter the number of ships and other military forces the United States feels it needs to protect itself and its allies. Delaying a decision about replacing amphibious ships would provide this country extra years to assess its defense needs before embarking on an expensive program of ship purchases.

Effects on Operating and Overhaul Costs

But will these older ships add greatly to the cost of operating and overhauling the fleet? Older ships may cost significantly more to operate. Some anecdotal evidence supports this assumption. Spare parts, for example, can be difficult and expensive to obtain for older ships because the parts may no longer be available, and the specifications or engineering drawings needed to manufacture new parts often are inadequate or unavailable. Also, the propulsion plants, especially the steam plants, of older ships can be difficult to repair, maintain, and operate.

Day-to-Day Operating and Support Costs. To determine whether any systematic linkage exists between age and factors that would lead to higher operating costs, CBO examined historical data on operating and support costs in the Navy's VAMOSC (Visibility and Management of Operating and Support Cost) data base for ships. The data base contains information on operating and support costs for Navy ships between 1978 and 1987. (Operating and support costs include those found in appropriations for military personnel and for operation and maintenance. All costs in the data base were converted to constant 1990 dollars.) Two classes of amphibious ships were analyzed: the LSD-28 Thomaston class dock landing ships and the LPH-2 Iwo Jima class amphibious assault ships. These classes were selected because they include ships that are older than those in other classes. During the years covered by the analysis, the average age of the LSD-28s increased from 23 to 31 years while the average age of the LPH-2s increased from 13 to 22 years.

The analysis revealed no relationship between a ship's age and total operating and support costs per vessel. Nor did the analysis find a

statistically significant connection between average age and one factor that could drive up operating costs--maintenance hours logged aboard the ship, on tenders (specialized ships that provide maintenance support), or at shore-based intermediate maintenance facilities. Finally, there was no evidence that older ships required more extensive nonscheduled repairs. Nonscheduled repairs might be required because older equipment on board might be more subject to unanticipated breakdowns. But for the LSD-28s and the LPH-2s, no statistically significant relationship existed between the average age of ships within each class and the amount spent on nonscheduled repairs per ship.

Despite these findings, operating costs could rise as ships are kept in the fleet beyond 30 years of service. The Navy has little experience operating amphibious ships with more than 30 years of service life, and the absence of clear statistical links could be the result of the relatively small number of ships for which data are available.

Scheduled Overhauls and Maintenance. Although day-to-day operating costs may not increase for older ships, those ships could require special overhauls and maintenance to extend their service life beyond the 30 years. For example, the Navy created the Service Life Extension Program (SLEP) for aircraft carriers to extend their service life from the 30 years originally planned to 45 years. Although the Navy does not currently plan a SLEP program for amphibious ships, it has proposed such a program in the past.[1] Furthermore, the Navy has cautioned that, if amphibious ships stay in service beyond the 35 years currently planned, then a SLEP might be required.

Concerns About Readiness. The readiness of the older amphibious ships to perform their missions may decline, especially if the Navy does not spend substantial sums on scheduled overhauls. Analysis of the VAMOSC data shows that, for at least one of the older classes of

1. In its 1984 defense budget, the Navy proposed a SLEP for the 11 LPD-4 Austin class amphibious transport docks. In 1985, the Navy testified that a SLEP was an economical alternative to replacing the LPD-4s, but was not suitable for the other classes of amphibious ships. The LPD-4 SLEP was designed to extend the ships' service life for 15 years. The first LPD-4 was scheduled to begin its SLEP in 1986. Each of the next three defense budgets (for 1985, 1986, and 1987) postponed the beginning of the LPD-4 SLEP for one year. After submission of the 1987 budget, the Navy canceled the LPD-4 SLEP, and did not include the program in budget requests for 1988, 1989, or 1990. Although the SLEP for the LPD-4s was canceled, the Navy plans to extend their service life, but for 5 years rather than 15. The Navy maintains that a SLEP is not required because some of the work envisioned in the LPD-4 SLEP will be done through routine maintenance and overhauls.

amphibious warfare ships, the Navy did not perform scheduled overhauls once those vessels were within a few years of their planned retirement. This may be a sensible policy, one that most car owners follow during the waning years of their automobile's lives. But if scheduled overhauls and modernization are not performed on older amphibious warfare ships that are close to retirement, these ships might not be as ready to perform their wartime missions as they were in earlier years when scheduled overhauls were performed routinely. They would certainly not be as ready to perform as newer ships. The problem may be exacerbated by a shift to the 35-year retirement rule, because vessels near 35 years of service may be even less capable of performing their missions than those near 30 years of service.

Effects on Capability

Despite concerns about operating costs, the key worry about older ships is that they may lack the improved technology available on newer ships. This improved technology may significantly increase the chances of success in a major amphibious assault.

In recent years, the Navy and the Marine Corps have emphasized the need to operate amphibious ships far away from the beach where the Marines will land. The Navy wants to operate the ships over the horizon from the beach, at a distance of 25 miles to 50 miles from shore.

Two systems are critical to carrying out operations at such distances: the LCAC landing craft and the CH-53E helicopter.[2] The LCAC is important because it is faster than the older landing craft it replaces, enabling ships to remain farther offshore. The LCAC is also easier to load and unload, which speeds transit and facilitates operations at greater distance. Finally, the range and speed of the LCAC permit greater flexibility in choosing landing zones.[3] The CH-53E

---

2. Two systems under development--the MV-22 Osprey aircraft and the advanced assault amphibian (AAA)--would also contribute to the ability to conduct an assault from over the horizon.

3. The LCAC rides over the water on a cushion of air, rather than in the water like the conventional displacement-hull landing craft (LCUs and LCMs) that it is replacing. Factors such as the presence of reefs and shallow water far from the beach can prevent the use of conventional landing craft. In contrast, many of these factors do not impose limitations on LCACs. The Marine Corps claims that while conventional landing craft would be suitable for about 20 percent of the world's coastline, LCACs can be used on about 70 percent.

helicopter is important because it is the only Marine Corps helicopter that can carry the Corps' standard medium artillery weapon (the M-198 155-millimeter howitzer), the trucks that tow the M-198s, and the Corps' light armored vehicles (LAVs)--the family of light attack vehicles used for mobility, reconnaissance, and other combat missions. If these vital weapons are to get to the beach by air, they must move on CH-53E helicopters.

Some older amphibious ships cannot accommodate these systems. Of the 53 amphibious warfare ships scheduled to retire by 2007 (assuming a 35-year service life), only 16 have well-decks that can accommodate LCACs. In contrast, all newer amphibious ships have such well-decks. Some older ships have difficulty operating the CH-53E Sea Stallion helicopter, because it is heavier than the older helicopters these ships were designed to support. Newer amphibious ships, especially the LSD-41 Whidbey Island class and LHD-1 Wasp class, have been designed from the keel up to support both the LCAC and the CH-53E.

The success of over-the-horizon assaults also depends critically on obtaining and relaying reliable intelligence about the assault area, and newer Navy ships--especially the LHD-1 Wasp class vessels--tend to have better communications equipment than older ones. Operating ships over the horizon greatly complicates the communications task during an amphibious assault because of the difficulty of operating communications systems that require a line-of-sight between the transmitter and the receiver. Over-the-horizon assaults also require better communications, compared with assaults launched closer to the beach, to ensure coordination of air- , sea- , and ground-based actions over a much larger area.

How important are the advanced capabilities found on newer ships? Highly important, according to the Navy and the Marine Corps. Having the capability to operate over the horizon increases the chances that the amphibious force can surprise the enemy and limits the ships' vulnerability to antiship missiles launched from shore. In contrast, some older Navy ships must steam very close to the beach--within three or four miles--to unload Marines and their equipment during an initial assault. At this range, the ships are vulnerable to gunfire and missiles, and enemies could easily determine the location of the Marines' initial landing.

Of course, the Administration's plan to retain ships for 35 years will not decrease the number of new, highly capable ships in the fleet; procurement plans determine that number. But the plan will reduce the proportion of the fleet that has advanced capabilities. This reduction could interfere with large amphibious operations, since the fleet may have to operate sufficiently close to the beach to accommodate the abilities of its least capable vessels.

DOWNWARD PRESSURE ON BUDGET SHARE

The discussion above noted that the Administration's plan would require the expenditure of $4.5 billion over the next five years to buy new amphibious ships and landing craft. Under reasonable assumptions, this level of funding would require allocation of about the same share of all shipbuilding funds to amphibious ships as occurred in the 1980s.

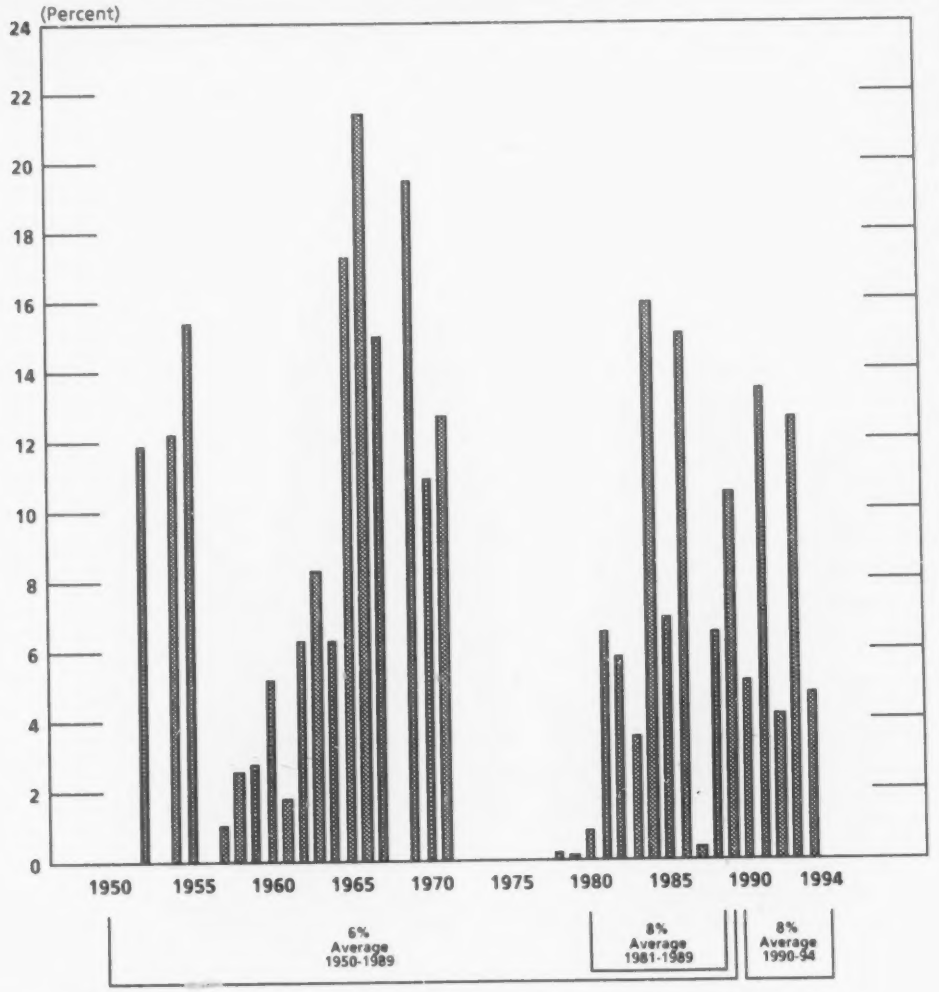
Although the Administration has published its naval shipbuilding budget for 1990 and 1991, its proposed funding for shipbuilding for 1992 through 1994 is not publicly available. However, if the shipbuilding account does not grow in real terms above the level proposed by the Administration for 1991, then amphibious ships would receive about 8 percent of the Navy's shipbuilding budget.

Between 1950 and 1989, the share of budget authority funding accorded to amphibious warfare ships and LCAC landing craft varied widely, from nothing in some years to as much as about 21 percent in others. On average, these ships received about 6 percent of budget authority in the Navy's Shipbuilding and Conversion (SCN) account, the account through which the Congress funds the construction of new warships (see Figure 3). Thus, the Administration plan exceeds the share of funds provided to amphibious shipping from 1950 to 1989.[4] From 1981 to 1989, however, these vessels received an average of about 8 percent of SCN budget authority, about the same as the share under the Administration plan.

4. The Administration plan also exceeds the average annual expenditure on amphibious ships over the same period. On average, amphibious ships received about $690 million (budget authority in 1990 dollars) per year between 1950 and 1989. The Administration plan calls for an average of about $890 million per year for amphibious vessels.

From one perspective, the similarity between the share of funds accorded amphibious ships in the 1980s and under the Administration plan suggests that the plan may be feasible and that the current goal

Figure 3.
Funding for Amphibious Ships as a Share of the Navy's Shipbuilding and Conversion (SCN) Account



SOURCE: Congressional Budget Office based on Department of the Navy data.

for amphibious lift could be met. But continued efforts to reduce the budget deficit will almost certainly include pressure to reduce defense spending, which could result in limits on shipbuilding funds.

Certain types of Navy ships are likely to enjoy a high priority for this limited funding. These ships include Trident ballistic missile submarines, which are needed to build up U.S. strategic capabilities; SSN-21 submarines, the Navy's new attack submarine that is designed to counter improvements in Soviet submarines; and DDG-51 guided-missile destroyers, which are needed to minimize the shortfall of escort vessels capable of accompanying aircraft carriers.

If the Congress fully funds the Administration's shipbuilding request for 1990 and 1991, and the shipbuilding budget does not grow in real terms from 1991 to 1994, then the Trident, SSN-21, and DDG-51 programs alone would consume about 75 percent of shipbuilding funds between 1990 and 1994.[5] Between 1981 and 1989, programs for the Trident submarines, nuclear attack submarines, and aircraft carrier escort ships (cruisers and guided-missile destroyers) consumed about 60 percent of the shipbuilding budget. Thus, if these categories of ships retain their high priority, then over the next five years the share of the shipbuilding budget available for other programs, including amphibious ships, could well decline.

Procurement of new aircraft carriers might further reduce the funds available for the other programs that include amphibious ships. Although the Administration's shipbuilding plan does not seek authorization for new aircraft carriers between 1990 and 1994, CBO estimates indicate that if the Navy is to maintain the Administration's goal of 14 deployable aircraft carriers while retiring older carriers after 45 years of service, five new carriers would have to be funded in the 1990s.[6] These carriers would replace the Forrestal and Kitty

5. Since the Administration's proposed funding for shipbuilding for 1992 through 1994 is not publicly available, this example assumed no real growth as a benchmark. Other funding scenarios are certainly possible. Whether the shipbuilding budget remains constant or declines will depend on specific actions taken by the Congress and the Administration in the coming years.

6. The Administration's budget contains advanced procurement funds in 1994 for one or two aircraft carriers. Advanced procurement funds are appropriated before ships are authorized, and they pay for items that take an especially long time to acquire. The Administration currently plans for authorization of these ships in 1996.

Hawk class carriers that will reach the end of their expected service life late in the 1990s and early in the next century.

If the share of funds available for buying amphibious ships shrinks significantly, the Administration and the Congress will have to consider alternatives to the Administration's current plan. The alternatives could involve reductions in the current goal for amphibious lift and choices about how modern a fleet to maintain. The next chapter addresses three such alternatives.

CHAPTER V

ALTERNATIVES TO THE ADMINISTRATION PLAN

Two key questions were raised in the preceding chapters regarding the Navy's ability to meet its goals for amphibious lift: how long does the Navy intend to operate the ships currently in the amphibious warfare fleet, and how many new amphibious ships will the Navy be able to buy during the 1990s? The Congressional Budget Office developed three options that illustrate the possible effects of different resolutions of these questions.

- Option 1 retains the Administration's plans for construction of new ships, but would save on operating and support costs through early retirement of certain amphibious ships.
- Option 2 purchases fewer new ships than the Administration, but would maintain the size of the amphibious fleet by extending the ships' service life from 30 to 35 years.
- Option 3 establishes a new, lower goal for amphibious lift, which could be met without procurement of any new ships between 1990 and 1994, even if ships' service life is reduced to 30 years.

Rather than predict likely results, the options are intended to illustrate a wide range of possible outcomes for amphibious lift in the 1990s. The Administration plan and three alternatives are described in Table 8; their effects on cost and capability are shown in Table 9.

OPTION 1: REDUCE OPERATING AND SUPPORT COSTS THROUGH SELECTIVE RETIREMENTS

To accommodate budgetary limits without reducing plans to procure new vessels, the Navy could decide to retire selected amphibious ships early. Ships selected for early retirement would be those not well suited for amphibious assault missions launched from over the horizon.

Thus, over the next five years, this option would result in a smaller fleet but one that has a large fraction of highly capable ships. By leaving unchanged the Administration's shipbuilding plan, the option would also ensure that modern ships are introduced in the future at the rate currently planned.

Of course, the Navy would have to decide exactly which older ships should be retired. That decision would presumably result from detailed analyses about the operational effectiveness of different combinations of ships, the current state of repair of individual ships, and other factors. For illustrative purposes, however, this option assumes that the Navy retires 11 older amphibious ships that are not well suited to over-the-horizon assaults--two Iwo Jima class (LPH-2) amphibious assault ships, three Charleston class (LKA-113) amphibious cargo ships, and six Newport class (LST-1179) tank landing ships (these ships are described in Appendix A). The Iwo Jima and Charleston class ships do not have well-decks and therefore cannot

TABLE 8. DESCRIPTION OF THE ADMINISTRATION PLAN AND ALTERNATIVES

	Number of Ships Purchased, 1990-1994		Assumed Age of Ships at Retirement (Years)	Number of Amphibious Ships in 1998
	Major Ships	LCAC Landing Craft		
Administration Plan	7	48	35	72
Option 1: Reduce Operating and Support Costs Through Selective Retirements	7	48	Varies, possibly less than 35	63
Option 2: Reduce Procurement Costs	5	41	35	70
Option 3: Reduce Goal	0	26	30	55

SOURCE: Congressional Budget Office.

operate landing craft efficiently. Ships from these classes were also selected because of other tactical and logistical considerations. The Newport class ships were selected because they would have to come very close to the shore in order to support the assault echelon. To ensure substantial operating savings in the near term, all 11 ships are assumed to be retired during 1991. This option would result in a fleet of 63 amphibious ships in 1998 compared with 72 ships under the Administration plan.

Cost Savings

A primary advantage of this alternative is its reduced operating and support costs relative to the Administration's plan. The amount of savings would depend on the type and number of ships that the Navy retires. If the Navy retired the 11 ships discussed above in 1991, then

TABLE 9. EFFECTS OF THE ADMINISTRATION PLAN AND ALTERNATIVES ON SELECTED MEASURES OF COST AND CAPABILITY

	Ships in 1998			Percentage of Goal Met by 1998		Cost Savings Relative to Administration Plan (Billions of dollars)		
							Operating and Support	
	Number	Average Age (Years)	Percentage 30 Years or Over	Current	Reduced	Procurement	1990-1994	1990-2000
Administration Plan	72	21.6	14	98-103	n.a.	n.a.	n.a.	n.a.
Option 1: Reduce Operating and Support Costs	63	20.6	14	83-103	n.a.	0.0	1.2	2.7
Option 2: Reduce Procurement Costs	70	22.2	14	91-98	n.a.	1.4	0.0	0.6
Option 3: Reduce Goal	55	22.3	0	66-79	103-129	3.6	0.6	4.2

SOURCE: Congressional Budget Office based on Department of the Navy data.

NOTE: n.a. = not applicable.

the cost of operating this smaller fleet would total about $1.2 billion less than the Administration plan between 1991 and 1994.[1]

This option could also result in savings not included in this figure. Keeping all amphibious ships for 35 years, for example, might entail substantial overhaul costs to keep the older ships in the fleet. By selectively retiring some older ships, the Navy could eliminate these costs.

Advantages and Disadvantages

This option, with its selected early retirements, could reduce tactical problems associated with having a wide variety of ships currently in the fleet. Many of the ships were built almost 30 years ago; others were built more recently and incorporate newer capabilities. If the Navy retires older, less capable ships, then the resulting amphibious fleet would be more homogeneous in capability.

At the same time, maintaining the Administration's planned shipbuilding program would allow new, highly capable amphibious ships to enter the fleet at the currently planned rate. All seven of the major ships the Administration plans to purchase during the 1990-1994 period would enter the fleet by 1998.

Finally, a smaller, more modern amphibious fleet may also increase the fleet's readiness to go to war. Newer ships might be in better physical condition than older ships. Some less obvious factors might also lead to increased readiness. For example, retention of well-trained sailors--a key to high readiness--is likely to be higher on newer ships because living conditions on newer vessels are better than those on older ones.

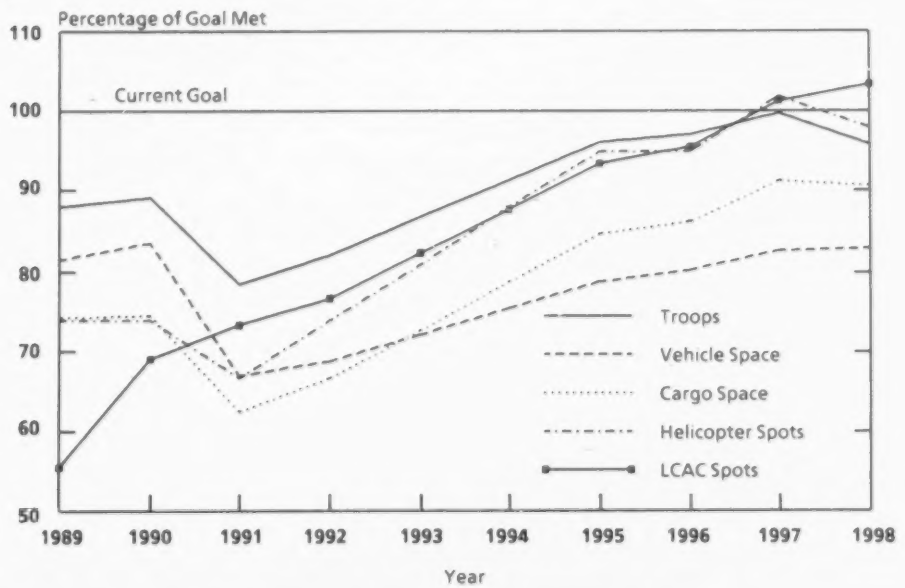
The primary disadvantage of this option is that it precludes the Administration from achieving its goal for amphibious lift during the

1. Estimates of savings in operations and support costs include direct and indirect costs. Direct costs are those that are tied closely to individual ships and include fuel, some supplies and spare parts, civilian and military personnel, modifications, and some weapons. Indirect costs pay for items that are necessary to support ships, but are not linked as closely to a particular vessel. Indirect costs include funds for operating naval bases, depot maintenance, training, management support, medical care, personnel support, logistics, and other centralized support functions. Direct costs account for about 65 percent of the estimated savings.

1990s. In 1998, the Navy would meet only about 83 percent of its goal for vehicle space, about 91 percent of its goal for cargo, 96 percent of its goal for troops, 98 percent of its goal for helicopter spots, and 103 percent of its goal for LCAC spots (see Figure 4).

Having a smaller amphibious fleet increases the risk that the Navy would not have enough amphibious ships to mount a very large amphibious assault. Since about 55 ships would be required to transport a Marine Expeditionary Force (MEF)--the largest Marine task force--the Navy would need to use almost all of the 63 amphibious ships to mount an assault with a MEF under this option. As was noted in the previous chapter, however, using all ships would be difficult without extensive warning, because ships based in the Atlantic Ocean

Figure 4.
Option 1: Reduce Operating and Support Costs Through Selective Retirements



SOURCE: Congressional Budget Office based on Department of the Navy data.

NOTE: The current goal is to provide enough capacity aboard amphibious ships to transport the assault echelons of one Marine Expeditionary Force and one Marine Expeditionary Brigade.

would need to travel to the Pacific Ocean, or vice versa, and some ships would probably be unavailable because of repairs. Thus, the Navy and Marine Corps probably could not mount a MEF-sized assault under this option. Certainly, they could not mount an assault with the assault echelons of a Marine Expeditionary Force and a Marine Expeditionary Brigade--the size of assault assumed by the plans that led to the current goal for amphibious lift.

OPTION 2: REDUCE PROCUREMENT COSTS

If the size of the fleet is a key goal, the Navy could respond to pressures to reduce the budget for the amphibious fleet by purchasing fewer new amphibious ships and LCACs, while continuing to operate all older amphibious vessels until they reach 35 years of age. By keeping older ships, Option 2 results in an amphibious warfare fleet of 70 ships in 1998, close to the 72 ships under the Administration plan and larger than the 63 ships under Option 1 (see Tables 8 and 9).

Spending for procurement of amphibious ships and LCAC landing craft, however, would be reduced by enough to provide amphibious ships with about 6 percent of the Navy's shipbuilding budget--the average share that they received between 1950 and 1989--rather than the 8 percent they would receive under the Administration plan. This option would also leave amphibious ships with a level of real dollars of budget authority similar to the one they received from 1950 through 1989. In order to accommodate reduced funding, this option cancels plans to purchase one of the two amphibious assault ships (LHD-1 Wasp class), one of the five dock landing ships (LSD-41(CV) Whidbey Island class, cargo variant), and seven of the 48 LCAC landing craft.

Cost Savings

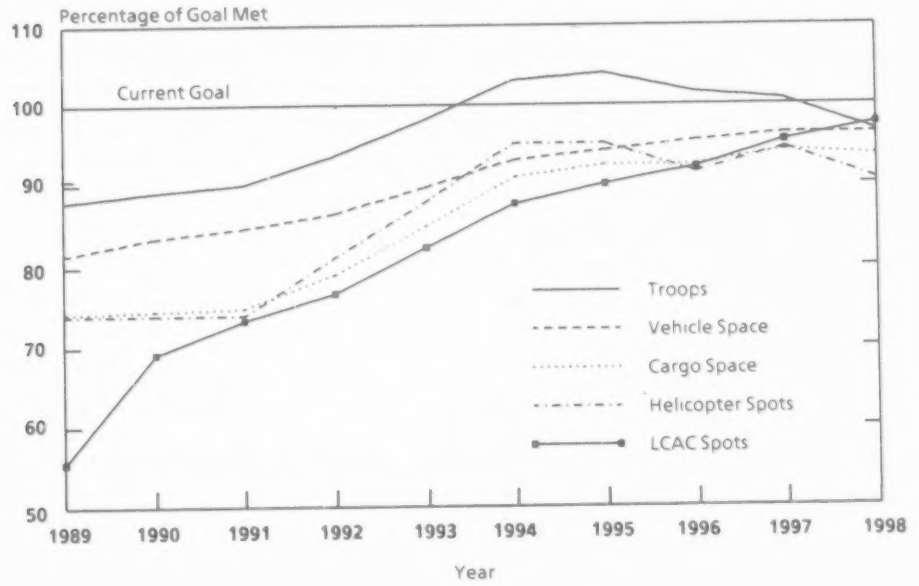
Like Option 1, the primary advantage of this option is its savings. Over the next five years, procurement costs would be reduced by $1.4 billion--similar to the savings under Option 1. Since the amphibious warfare fleet is almost the same size under this option as it would be under the Administration plan, savings in operating and support costs relative to the plan are small.

Advantages and Disadvantages

Even though it would procure fewer ships, Option 2 would come close to meeting the current goal for amphibious lift. Between 91 percent and 98 percent of the goal for the different lift categories would be met in 1998, as illustrated in Figure 5. By keeping a larger amphibious fleet, this option limits the risk that the United States would not have enough ships to conduct a very large amphibious assault.

But retaining all amphibious warfare ships in the fleet for 35 years involves the risks discussed in Chapter IV. The amphibious fleet would contain more older vessels under this option than under Option 1. These ships may be less habitable than newer vessels, which could adversely affect retention of trained sailors and Marines. Also,

Figure 5.
Option 2: Reduce Procurement Costs



SOURCE: Congressional Budget Office based on Department of the Navy data.

NOTE: The current goal is to provide enough capacity aboard amphibious ships to transport the assault echelons of one Marine Expeditionary Force and one Marine Expeditionary Brigade.

the older ships kept in the fleet would not have newer technologies that may be critical to the success of a large amphibious assault. Finally, reducing procurement would also reduce the number of new, highly capable vessels that could be entering the fleet in the late 1990s.

OPTION 3: REDUCE GOAL FOR AMPHIBIOUS LIFT AND RETIRE SHIPS AFTER 30 YEARS

Procurement budgets for amphibious ships might face an even sharper reduction in funding over the next five years than was assumed in Option 2. Even if all older ships remain in the fleet for 35 years, a sharp reduction in funding could probably not be accommodated without a reduction in the goal for amphibious lift.

Option 3 adopts today's amphibious lift capability as a new, reduced goal for amphibious lift. The Navy can now transport the assault echelon of one Marine Expeditionary Brigade (MEB) on each coast, plus a small additional force. Thus the new goal is to provide amphibious lift for the assault echelons of 2.30 MEBs--one MEB on each coast, plus an additional 15 percent of lift capability on each coast to allow for ships that are in overhaul or are otherwise unavailable. With this capability, the Navy could move a MEB on each coast on short notice.

This option assumes that, in meeting this lower goal, the Navy retires amphibious ships after 30 years of service rather than 35 years as in the Administration's plan. It also assumes that, faced with a smaller fleet, the Navy would want a more modern fleet. Alternatively, of course, the Navy could selectively retire older ships, perhaps in the manner assumed in Option 1.

If older amphibious ships are kept in the fleet for only 30 years, the new goal could be met through 1998 without procurement of any large amphibious ships during the next five years. Procurement of LCAC landing craft could be reduced to 26 vessels through 1994 to reflect the reduced number of LCAC well-deck spots that would be available in the smaller fleet (see Tables 8 and 9). Five years without procurement of any large new amphibious ships would not be without historical precedent. As shown in Figure 3 in Chapter III, there have been a

number of procurement holidays; one that occurred during the 1970s lasted more than five years.

Of course, this procurement holiday could not last forever. After 1998, the Marine Corps would begin to lose the capability to transport 2.30 MEBs unless changes were made. The service life of existing ships would need to be extended beyond 30 years, or new amphibious ships would need to be authorized after 1994 to maintain lift for the assault echelons of 2.30 MEBs.

Cost Savings

Option 3 would save substantially more money than the other options. Compared with the Administration plan, canceling the procurement of new amphibious ships would save $3.6 billion, a reduction of about 80 percent. Over the next five years, real funding for amphibious shipping would be only about 20 percent of its level in the previous five years--a reduction that could help lower the overall defense budget or could accommodate increases in funding for ships of higher priority while keeping the total shipbuilding budget at its current level.

In addition, the savings associated with lower costs of operating and supporting a smaller fleet would total $4.2 billion between 1990 and 2000. Most of those savings would occur after 1994. Indeed, by 1998, when this option is fully implemented, annual operating and support costs would be about $700 million lower.

Advantages and Disadvantages

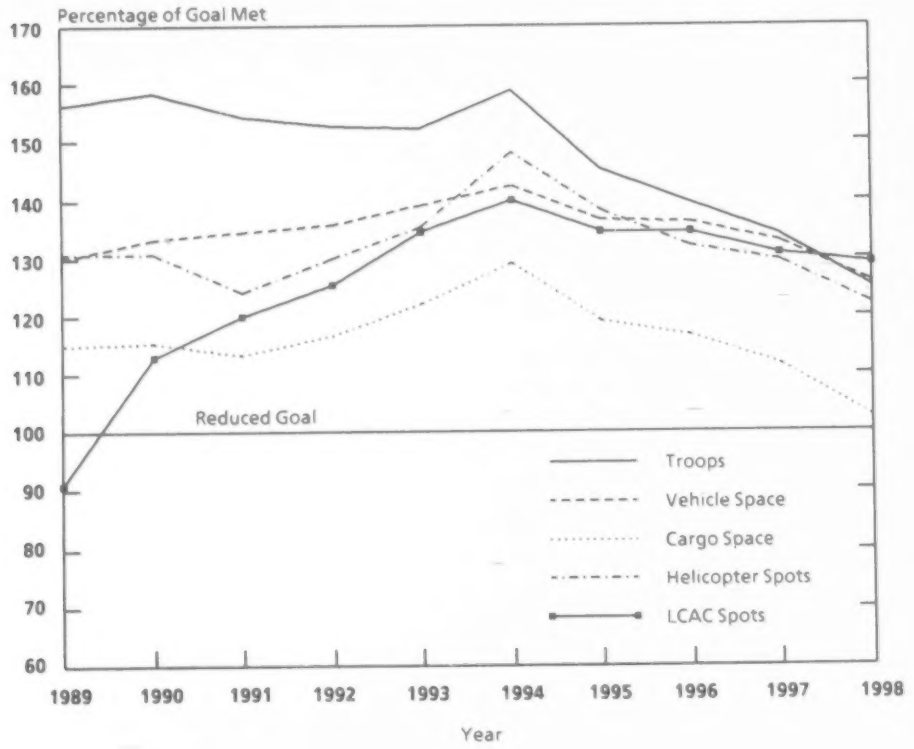
Would this option provide the United States with enough amphibious lift? Yes, according to defense experts who argue that large amphibious assaults are militarily obsolete. If the United States will never again mount an amphibious assault like those of World War II, then the minimal investment in amphibious ships under this alternative seems appropriate.

Moreover, because this option retires ships after 30 years, the remaining force would have fewer older vessels than the fleet created by the Administration plan. Thus, compared with that plan, a larger

fraction of the fleet would have the newest capabilities that are needed to provide confidence of success during an amphibious assault against an enemy equipped with technology such as precision-guided missiles.

Nor, judged by the standards of the past four decades, would the smaller force be inadequate. The landing at Inchon involved about two Marine Expeditionary Brigades, a force that could be transported us-

Figure 6.
Option 3: Reduce Goal for Amphibious Lift and Retire Ships After 30 Years

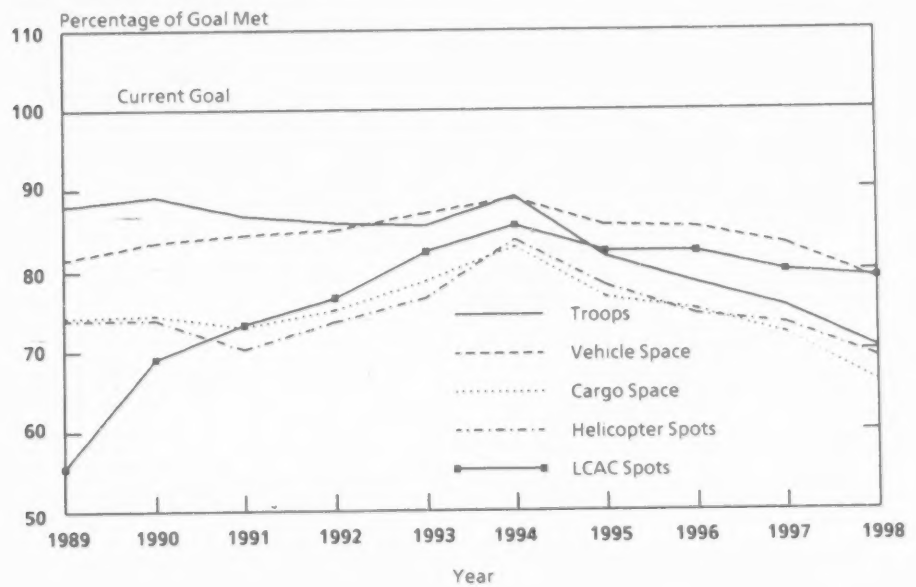


SOURCE: Congressional Budget Office based on Department of the Navy data.

NOTE: The reduced goal would provide the capability to transport the assault echelon of two Marine Expeditionary Brigades, plus a small additional force (2.30 MEBs). This goal would match today's capability for amphibious lift.

ing the ships maintained under this option if there were enough warning to allow the transfer of ships from coast to coast. Since Inchon, all the important engagements involving amphibious capability have used forces much smaller than the one that could be transported under this option. The largest landing since Inchon occurred in Lebanon in 1958 and involved an initial landing of 1,700 Marines. The Marine Expeditionary Brigade on each coast could land about 12,000 troops, far more than the Lebanon landing or any other since Inchon.

Figure 7.
Option 3: Amphibious Lift Under the Reduced Goal of Option 3 Compared With the Current Goal



SOURCE: Congressional Budget Office based on Department of the Navy data.

NOTE: The current goal is to provide enough capacity aboard amphibious ships to transport the assault echelons of one Marine Expeditionary Force and one Marine Expeditionary Brigade. The reduced goal would provide the capability to transport the assault echelon of two Marine Expeditionary Brigades, plus a small additional force (2.30 MEBs). This goal would match today's capability for amphibious lift.

Under this option, however, the size of the amphibious warfare fleet would decline more rapidly than under any of the other approaches discussed in this study. Option 3 would result in 55 amphibious warfare ships in 1998, compared with 63 under Option 1, 70 under Option 2, and 72 under the Administration plan. But this smaller fleet would exceed Option 3's reduced goal through 1998 (see Figure 6 on page 54).

Clearly, this option would mean abandoning the notion of being able to mount a very large amphibious assault. Figure 7 on page 55 shows how amphibious capability under this option compares with the current, larger goal for amphibious lift. By 1998, the amphibious fleet could meet only between 66 percent and 79 percent of the current goal.

Moreover, for at least five years, this option would halt the procurement of modern, more capable amphibious warfare ships. This hiatus would limit the Marine Corps' ability to conduct assaults from over the horizon.

CONCLUSION

If the Congress elects to fund new amphibious warfare ships at the same share of the shipbuilding budget they received throughout the Reagan Administration and to continue the commitment to a strong amphibious force, then the Administration's plan would be an appropriate course of action.

If the Congress decides to decrease funding for the amphibious warfare fleet, then a choice must be made: either reduce operating and support costs by retiring some older ships (Option 1) or reduce procurement costs by canceling plans to build some new vessels (Option 2). Option 1 would result in a smaller, but somewhat more modern amphibious fleet. Option 2 would maintain a fleet almost as large as that proposed by the Administration, but it would be older.

If, however, the Congress decides to sharply reduce funding for amphibious forces, then the goal for amphibious lift would almost certainly have to be revised downward. Option 3 illustrates such an approach.

A substantial bill for maintaining amphibious lift capability will come due during the next decade because of the aging of a large number of amphibious vessels built in the 1950s and 1960s. This bill will be presented during a period of easing of East/West tensions. Although amphibious ships themselves are not covered by any of the proposals for reducing conventional arms, a significant easing of tensions would increase pressure to reduce most types of defense spending, including spending on amphibious shipping. Each of the options in this study represents one possible approach to slowing spending on new amphibious ships and reducing the size or capability of the amphibious fleet.

APPENDIXES

APPENDIX A

TYPES AND CLASSES OF AMPHIBIOUS SHIPS

The Marine Corps relies on amphibious ships procured and operated by the Navy to transport its troops and equipment. Ships that are currently in the amphibious fleet or under construction are discussed below by type of ship (see Table A-1). This appendix also includes a section on landing craft and ships that are still in the design stage.

TABLE A-1. CURRENT AMPHIBIOUS SHIPS AND SHIPS UNDER CONSTRUCTION

Ship Class	Current Inventory[a]	Under Construction[b]
Amphibious Assault Ships		
LHD-1 Wasp	1	3
LHA-1 Tawara	5	0
LPH-2 Iwo Jima	7	0
Dock Landing Ships and Transport Docks		
LSD-41 Whidbey Island	4	4
LSD-41 (CV) Whidbey Island, Cargo Variant	0	1
LSD-36 Anchorage	5	0
LSD-28 Thomaston	1	0
LPD-1 Raleigh	2	0
LPD-4 Austin	11	0
Other		
LST-1179 Newport	20	0
LKA-113 Charleston	5	0
LCC-19 Blue Ridge	2	0
Total	63	8

SOURCE: Congressional Budget Office based on Department of the Navy data.

a. As of October 1989.

b. Ships authorized by the Congress through 1989, but not yet delivered to the Navy.

CURRENT AMPHIBIOUS SHIPS

Each Navy ship can be distinguished by its type and class. Ship types are general groupings for ships that perform similar missions. For example, the terms "aircraft carrier" and "frigate" refer to ship types. Ship types typically are composed of ships from different classes. Ship classes are much more specific: all ships within a class have the same design. Classes can be as small as one ship or as large as tens of ships. This section describes the different types and classes of amphibious warfare ships.

Amphibious Assault Ships

The Navy operates three different classes of amphibious assault ships. The primary mission of these ships is to serve as floating airfields.

LHD-1 Wasp Class. The LHD-1 is the largest amphibious warfare ship in the world. The Congress has funded four of these ships to date, the first of which entered the fleet in July 1989. The LHD-1 displaces more than 40,000 tons and has an 800-foot flight deck on top, with a hangar deck and cargo storage decks below.

The primary mission of the LHD-1 is to serve as a floating base for helicopters, AV-8B Harrier jets, three LCAC (landing craft, air cushion) hovercraft, and about 1,900 Marine Corps troops and their equipment. The LHD-1s also have extensive communications facilities, allowing them to serve as the headquarters for amphibious task force commanders. The Navy states that, in addition to their role in amphibious assault operations, the LHD-1s can be easily and quickly converted for sea control missions by unloading some of the helicopters they would normally carry and replacing them with AV-8B Harrier jets. The LHD-1's design is quite similar to that of the Navy's LHA-1 Tawara class amphibious assault ships, though modifications have improved the ship's ability to operate and support AV-8Bs and LCACs. The LHD-1s will replace the seven LPH-2 Iwo Jima class ships scheduled to retire around the turn of the century.

LHA-1 Tawara Class. The Navy operates five LHA-1 Tawara class amphibious assault ships. The LHA-1s are similar in size to the LHD-1 Wasp class ships. Like the LHD-1s, the LHA-1s' wartime mis-

sion is to transport aircraft and cargo to support amphibious operations. They carry aircraft, including the AV-8B Harrier, one LCAC, and three conventional landing craft. The LHA-1s entered the fleet between 1976 and 1980.

LPH-2 Iwo Jima Class. The seven LPH-2 Iwo Jima class assault ships also serve as helicopter carriers. These ships are smaller than the LHD-1 and LHA-1 ships, displacing about 18,000 tons, and they carry fewer helicopters. Since the LPH-2s do not have a well-deck, they cannot transport LCACs and conventional landing craft. They entered the fleet between 1961 and 1970.

Dock Landing Ships and Transport Docks

Dock landing ships and transport docks carry vehicles, cargo, and troops and operate landing craft from their well-decks.

LSD-41 and LSD-41(CV) Whidbey Island Class. The LSD-41 Whidbey Island class dock landing ships and the LSD-41(CV) "cargo variant" are designed to operate the LCAC hovercraft from a well-deck at the stern of the ship. The cargo-handling capabilities of these ships, combined with the high-speed operations of the LCAC, allow the ships to unload and transport their cargo of equipment and vehicles quickly from ship to shore. The Congress has funded eight LSD-41s, of which four are now serving in the fleet and four are under construction. The first cargo variant was authorized for 1988 and is scheduled to enter the fleet in 1994.

These ships displace about 17,000 tons, are about 600 feet long, and have landing spots for two helicopters at the stern. The basic design of the LSD-41 was modified so that the LSD-41(CV)s will carry two instead of four LCACs to make room for more cargo. To reflect these modifications, the Navy is considering changing the name of the cargo variants' class to LSD-49 Harper's Ferry class. The LSD-41s and LSD-41(CV)s will replace the LPD-1 Raleigh class and LPD-4 Austin class ships scheduled to retire around the turn of the century.

LSD-36 Anchorage Class and LSD-28 Thomaston Class. The Navy operates six dock landing ships of the LSD-36 Anchorage class and the LSD-28 Thomaston class. The one remaining Thomaston class ship is

over 30 years old, and the Navy intends to retire it in 1990. Like the LSD-41s, these ships ferry cargo and landing craft for amphibious operations.

LPD-1 Raleigh Class and LPD-4 Austin Class. The two LPD-1 Raleigh class and eleven LPD-4 Austin class amphibious transport docks perform missions similar to that of the LSD-41. In a war, they would carry cargo to support amphibious landings. These ships are about the same size as the LSD-41s, and the LPD-4s can operate one LCAC as well as conventional landing craft.

Other

In addition to amphibious assault ships and dock landing ships and platforms, the Navy operates three other types of ships: tank landing ships, cargo ships, and command ships.

LST-1179 Newport Class. The 20 LST-1179 Newport class tank landing ships would be used in a war to transport amphibious personnel carriers, referred to as assault amphibian vehicles (AAVs), from U.S. bases to an amphibious assault. About 20 AAVs can be stored in the well-deck of each LST. While the ship is under way, AAVs can be floated out the stern of the ship. The AAVs, which carry about 20 Marines and their equipment, can travel to shore and operate as personnel carriers on land.

Alternatively, LSTs can beach themselves and unload vehicles through a ramp in the bow. The LSTs are the smallest amphibious warfare ships, displacing about 8,500 tons when fully loaded. The Navy commissioned the first LST-1179 ship in 1969, and the twentieth ship was delivered in 1972. Two LSTs are currently assigned to the Navy reserve.

LKA-113 Charleston Class. The Navy designed the five LKA-113 Charleston class amphibious cargo ships to carry heavy equipment to support amphibious assaults. The LKA-113s are dedicated cargo and vehicle carriers. Since they lack a well-deck, cargo and vehicles must be unloaded over the side by the cranes (onto landing craft, barges, or onto vehicles on floating causeways that connect LKA-113s to the shore) or by helicopters. A helicopter landing pad allows cargo helicop-

ters to ferry equipment from ship to shore. The LKA-113s entered the fleet between 1968 and 1970.

LCC-19 Blue Ridge Class. The Navy operates two LCC-19 Blue Ridge class command ships, which entered the fleet in 1970 and 1971. These ships were designed to operate communications equipment that would be used during amphibious assaults. Because of their extensive communications capabilities, both LCC-19s currently serve as flagships for Navy fleet commanders, and therefore they are not available on a day-to-day basis to support Marine Corps training and operations. Nevertheless, the Navy and the Marine Corps include the LCC-19s in the amphibious fleet.

LANDING CRAFT

The Navy operates three different types of large landing craft to transport troops and vehicles from ship to shore.

LCAC (Landing Craft, Air Cushion). The LCACs ride over the water's surface on a cushion of air, rather than through the water, which allows them to land on the beach--a potentially important tactical advantage. In contrast, other landing craft must unload troops and equipment in the surf. The LCACs' maximum speed exceeds 40 knots. Each can carry 60 tons of cargo, with an overload capacity of 75 tons. An enclosed crew compartment can accommodate 24 troops. The LCACs can operate from LHD-1 Wasp class, LHA-1 Tawara class, LSD-41 Whidbey Island class, LSD-36 Anchorage class, and LPD-4 Austin class ships. They displace about 100 tons.

The first LCAC was delivered to the Navy in 1984. The Congress has funded production of 48 LCACs through 1989. The Administration plans to buy an additional 48 LCACs between 1990 and 1994, with a total program goal of about 107 units.

LCU-1610. The Navy operates 39 LCU-1610 class landing craft. These vessels were first built in the late 1950s, although some were built more recently. LCU-1610s, which displace about 190 tons, can carry about 170 tons of cargo at a speed of about 12 knots. They can be operated from every amphibious ship with a well-deck, except the

LST-1179 Newport class tank landing ships. The Navy does not plan to buy additional LCU-1610s in the 1990s.

LCM-8 and LCM-6. The Navy operates 121 LCM-8 landing craft. These craft are smaller than the LCU-1610s, displacing about 34 tons, and each carries about 60 tons of cargo. The maximum speed of the LCM-8s is about 12 knots. The Navy plans to buy 10 LCM-8s in 1990 and 10 more in 1991 for use aboard LKA-113s.

Smaller still are the 98 LCM-6 landing craft, which displace about 27 tons. They carry about 34 tons of cargo and have a maximum speed of about 10 knots. The Navy does not plan to buy new LCM-6 craft.

FUTURE AMPHIBIOUS SHIPS

The Navy and the Marine Corps are in the preliminary stages of designing a new amphibious assault ship, designated the LX. Design work on the LX is scheduled to be completed in 1994, with the first LX planned for Congressional authorization in 1996. As currently envisioned by the Navy, each LX will carry about 700 troops, with 25,000 square feet for vehicles, 25,000 cubic feet for cargo, and spots for helicopters and at least one LCAC. If the schedule does not slip, the first LX would enter the fleet around 2001. The Commandant of the Marine Corps has testified that about 20 LXs would be required early in the next century.[1]

Although design work on the LX will not be completed until the mid-1990s, the Navy and the Marine Corps recently studied the possibility of applying advanced technology to future amphibious warfare ships. In the *Conference Report on the National Defense Authorization Act for Fiscal Year 1989*, the Congress directed the Secretary of the Navy to study new types of advanced-technology ships for fast sealift and for amphibious missions. In response, the Navy published the *Fast Sealift Program Technology Assessment Report* in January 1989, which examined three hull forms: a modification of existing conventional monohull cargo ships, a semiplaning monohull design, and a

1. Statement of General A.M. Gray, Commandant, U.S. Marine Corps, before the Projection Forces and Regional Defense Subcommittee of the Senate Armed Services Committee, Washington, D.C., April 14, 1988.

surface-effect ship (SES). Semiplaning monohulls ride higher in the water at high speed, which decreases the surface area of the ship in the water, thereby decreasing drag and increasing speed. Some semiplaning monohulls have been built in Europe for fast attack missions. Surface-effect ships ride on a cushion of air over the water.

The report highlighted the technological risks the Navy would face while developing large semiplaning monohulls and SES ships. Although relatively small semiplaning monohulls and SES ships have been built, the size of these ships would have to be increased dramatically for them to be effective in amphibious assault missions. For example, the largest semiplaning monohull built to date displaces 600 tons; the report examined one that would displace more than 25,000 tons. Today's largest SES ship displaces 200 tons; the report examined an SES ship that would displace more than 21,000 tons. It is not clear whether naval architects could overcome the risks inherent in building such large ships based on these two advanced technologies.

Despite these risks, the Marine Corps is interested in advanced-technology ships, especially SES ships. Yet it is unlikely that the LX, which represents the next generation of amphibious ships, will be an SES ship. Since the first LX is scheduled for authorization in 1996--beyond the current five-year plan--LXs are not addressed in detail in the text or in the options of this study.[2] The Navy, however, will continue to develop the design for the LX over the next five years, and the Congress will face choices regarding the program as it matures.

---

2. Some analysts, however, have written about amphibious ship procurement beyond 1994. One concern raised is that the amphibious fleet is becoming composed of large ships that are bought in relatively small numbers, even though a greater number of smaller ships might have better warfighting characteristics. See, for example, Thomas C. Linn, "Amphibious Shipping Shortfall Undermines Maritime Strategy," *Armed Forces Journal International* (April 1989), p. 54.

APPENDIX B

LONG-TERM FUNDING FOR AMPHIBIOUS SHIPS AND LANDING CRAFT

Between 1990 and 1994, the Administration seeks an average of about $890 million of budget authority (in 1990 dollars) per year to build new amphibious ships. When the last of these ships is delivered in 1998, the Administration will reach its goal for amphibious lift, except for a shortfall of 2 percent in the capability to carry helicopters (see Chapter IV). To sustain this goal beyond 1994, the Navy will need to continue to build amphibious ships to replace those retiring toward the end of this decade and shortly after the year 2000. Over the long run, the annual costs for sustaining the goal may be greater than the average of $890 million requested in each of the next five years.

Congressional Budget Office (CBO) estimates show that the goal for amphibious lift may be sustained beyond 1998 with an average annual investment in amphibious shipbuilding of about $755 million, provided that the real costs for the lift capacity of the replacement ships--measured in dollars per unit of lift provided (that is, dollars per helicopter deck spot, per troop transported, and so on)--do not exceed those of ships that retire. This caveat is of critical importance. If the capacity of new ships costs more than the capacity aboard the ships that they replace, then the annual investment required to maintain the Administration's goal would rise quickly above $755 million.

Are the costs of amphibious lift in new amphibious ships increasing relative to those of the older ships they replace? To answer this question completely, one must compare the changes between generations of ships in the costs of carrying each of five items: troops, vehicles, cargo, and space for aircraft and landing craft.

A preliminary estimate, however, can be made by focusing on one important lift category--the space aboard ships for aircraft. Changes in the cost of carrying aircraft are important because the LHD-1 Wasp class ships are the largest and most expensive amphibious ships in the Administration's shipbuilding plan, and their primary mission is to transport aircraft. The LHD-1s will replace the LPH-2 Iwo Jima class

ships that entered the fleet between 1961 and 1970. Thus, the average real growth in dollars per aircraft deck spot between the LPH-2s and the LHD-1s is one important measure of changes in the costs between generations of amphibious ships.

Of course, a direct cost comparison between LHD-1s and LPH-2s, even when adjusted for their different aircraft-carrying capacity (45 deck spots on the LHD-1s; 23 on the LPH-2s) can be misleading. Although the LHD-1s cost more than the older LPH-2s, they are undoubtedly much more capable. For example, the LHD-1s have vastly improved communications gear. They also have well-decks, which the LPH-2s lack, that allow them to support LCAC operations. Nevertheless, for the purposes of estimating the average annual investment that would be required to continue to meet the goal for amphibious lift over the long run, the key question remains unchanged: Are costs for new amphibious ships increasing per unit of amphibious lift?

The average annual real cost growth for transporting aircraft can be derived from the following formula:

$$\{[\text{LHD Cost} / (\text{Equal Lift Factor} \times \text{LPH Cost})]^{1/\text{Years Between Deliveries}}\}-1$$

where:

LHD Cost = $1.063 billion, the average cost (budget authority appropriated or proposed, expressed in 1990 dollars) for the first six LHD-1s (the four already funded plus the two in the Administration's shipbuilding plan through 1994).

Equal Lift Factor = 1.96, a factor to equate the helicopter-carrying capabilities of the LPH-2 and the LHD-1. Since an LPH-2 has 23 CH-46E-equivalent deck spots and the LHD-1 has 45, this factor is 45/23 or 1.96--that is, 1.96 LPH-2 vessels would be required to carry the same number of helicopters as one LHD-1. Costs for the LPH-2 vessels were increased accordingly.

LPH Cost = $356.4 million, the average cost (budget authority appropriated, expressed in 1990 dollars) for the seven LPH-2s.

Years Between Deliveries = 28, the number of years between the delivery of the fourth LPH-2 (1965) and the third LHD-1 (1993).

The formula yields an average growth in costs of 1.5 percent a year.

This result does not mean that total costs for replacing capacity as ships retire in the late 1990s and early in the next century will increase at an annual real rate of 1.5 percent. Rather, that rate will depend on factors such as the cost, number, and mix of amphibious ships that the Navy will buy over the coming years. This calculation indicates, however, that for at least one important measure, the real cost of replacing lift capacity is increasing.

Real cost growth would affect the level of funding required to sustain the goal for amphibious lift over the long run. For example, if the costs for the lift capacity of new ships grew in real terms by 1 percent a year for 35 years, then the average annual investment required to maintain the current goal would jump from $755 million to about $900 million, slightly above the $890 million average annual funding in the Administration plan. Annual real growth of 2 percent would require an average yearly investment of about $1.1 billion, an increase of more than 25 percent above the average funding projected for the next five years. Indeed, real annual cost growth beyond about 1 percent could require real growth in the average annual funding for amphibious shipbuilding.

Although this analysis is limited in the sense that it considers only one aspect of the goal for amphibious lift, it suggests that if the Congress wishes to meet and maintain that goal, then it will probably have to continue to build new amphibious ships after 1994 and fund their construction at or above the level of average annual funding in the Administration plan.

CONGRESSIONAL BUDGET OFFICE
Second and D Streets, S.W.
Washington, D.C. 20515

FIRST-CLASS MAIL
POSTAGE & FEES PAID
C.B.O.
WASHINGTON, D.C.
PERMIT No. G-70

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300